THE

Practical Teacher

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Edited by JOSEPH HUGHES.

'Knowledge is proud that he has learned so much,
Wisdom is humble that he knows no more.'—COWPER.

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School Surgery.

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VI.

CHILBLAINS AND CHAPS.

CLOSELY allied to boils in appearance, but not in cause are the swellings which are produced by frost and cold. Chapped hands arise, in a great measure, from neglect in not sufficiently drying them after they have been washed. If they are exposed to the cold air in a damp state, the effect of evaporation is to chill the cuticle. When there is a low state of vitality in the system the consequence is soon manifest. The cuticle is destroyed, and is thrown off before its natural exfoliation is complete. The result is a rapid rise of a so-called inflammatory action. Heat, redness, a swelling with some amount of tenderness, supervene in the swollen part. Some children are much more susceptible to a chapped state of skin than others, from constitutional weakness. When the chilled condition has extended to the cutis vera, or true skin, a chilblain is produced. These effects are very prone to form in those who have a weak circulation; who are the children of persons who have been addicted to high living; who have trusted to meat and stimulants as the staple articles of food, rather than to more simple diet, and who have not had a proper supply of milk and vegetables. The fingers and toes, the tips of the ears and nose, sometimes parts of the skin on the arms and legs are affected. In the case of chaps, the mischief is limited to the cuticle. Every one who does not dry the skin thoroughly is liable in cold weather to have this condition produced. The greatest care should be taken to remove all moisture from the skin, especially in cold and frosty weather. It is beneficial to smear the hands with a minute quantity of honey, after washing and before drying, when the weather is really cold. The application of honey makes the drying a more tedious process, but it is capable of being more thoroughly performed than when honey is not used. If the chaps have been actually produced, and the skin is cracked, it requires the application of something more stimulating than honey. I generally use an ointment such as the following:—One part of camphor, six parts of spermaceti ointment, and one part of citron or golden ointment. These should be thoroughly well mixed, and the cracks smeared with the mixture at bedtime, after the hands have been well washed and properly dried. Two or three applications will be sufficient to effect a cure. The parts smeared with the ointment should be covered up by berlin or silk gloves. The lips are sometimes chapped; they should be painted with a little solution of the tannate of glycerine, and the application allowed to remain upon it for a few minutes before it is wiped off. The cracks should then be touched by a little strong camphorated oil—four parts of salad oil, and one of camphor, being rubbed together so as to make an application; the thinnest possible coating should be applied by the aid of a camel's-hair brush; or a camphor ball, such as all druggists supply, may be used. If the chill has extended to the cellular tissue, there is active inflammation. The vitality of some of the minute capillaries has been interfered with, and the blood has stagnated in them. As a consequence, there is obstructed circulation, and a local dropsy results. Children who have been accustomed in cold weather to wash in hot water are more liable to chilblains than others, especially if they have been improperly fed. Any sudden change of temperature, ranging below 40° may produce chilblains, though they are much more decided when the temperature is absolutely below the freezing-point. Those adults who are accustomed to wash their hands in hot water in frosty weather are very liable to them. Children whose feet are kept too hot, or who are badly shod, and who get their feet damp in severe weather, suffer much from the effects. There is impeded circulation, then an intolerable itching, and scratching only adds to the pain and the inflammation. If the malady be properly treated, it remains a simple chilblain, and is soon removed, but if the process of exposure be continued, if it be scratched excessively, the skin breaks, and the cellular tissue beneath is exposed, and then a painful sore results. The best kind of treatment is a gentle friction with a warm hand. If the skin is not broken, the part affected may be covered up, and supported by chamois leather spread with lead plaster; but if the skin be broken, a stimulating ointment may be applied. The best kind

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is, one part of turpentine rubbed up with seven parts of yellow basilicon, and applied on lint twice or three times a day, taking care to keep the affected part perfectly dry. Persons who are very sensitive to cold, and upon whom chilblains easily appear, should take a dessert spoonful of cod-liver oil every night on going to bed, when the thermometer shows a temperature constantly below freezing point. Stimulants, such as wine and beer, will not assist to remove the cause which allows of the production of chilblains, although they are remedies which are much vaunted by some authorities.

I can scarcely pass over the subject of frost-bite, though it rarely happens in this country, but now and then a child does inadvertently get frost-bitten in very severe weather. A condition, which corresponds to that producing chilblains, extends in the tissues beneath the skin until the vitality of the organ may be entirely destroyed. There is numbness at first; an attempt is made to restore the circulation, there is intense pain; the mischief is done before the latter arises at all; when children's fingers are frost-bitten, as will happen sometimes when they are intent upon snow-hut building, or even snow-balling, it is very imprudent to warm them by exposure to a fire, or by plunging them into hot water; the chilled part should be only rubbed with a warm hand, using at first a little snow-water, and then simply the heat of the hand itself, and very gently, too, until the deadly pallor in the part which announces the arrest of circulation gives way to a more florid aspect. This must be done carefully and slowly, otherwise mortification will be the natural result. Powerful stimulants are to be utterly avoided; they are certain to produce mischief. Some other directions will be given upon this head when treating of the rescue of drowning persons.

DISEASES OF THE SKIN.

The transition from boils and chaps and chilblains to diseases of the skin appears to be a most natural one, but it is not strictly scientific. As, however, we are treating this subject from a popular point of view, we may consider this troublesome and disagreeable set of cases at this part of our subject. The skin is often much damaged by the continuous poulticing to which boils and blains are but too often subjected, and some of the most obstinate skin affections date their commencement from some application which has been used for some other object. I have already treated of the class of maladies which are styled eruptive fevers, or 'the Exanthemata,' as they are termed by medical men. They are attended by high fever, and are all infectious or contagious. They include Measles, Scarlet Fever, Small Pox, '*et id genus omne.*' Another class of infectious complaints, which are truly parasitic, affecting the hair and skin, have also been already dealt with. It remains now only to take account of those diseases of the skin which are called tetters, breakings out, scorbutic affections, etc. They are chronic in their course, and are not usually attended by feverish disturbances. Some of them are very difficult to cure, and leave lasting impressions behind them. There are several distinct classes, such as papules or pimply diseases; squamous or scaly affections; others are vesicular or pustular. These divisions are not natural, a papule may become a pustule, and a vesicular disease, such as eczema, may lapse into a scaly kind. Others are simply blisters, whilst the disease called Itch may take on almost every kind of form, viz., pustular, papular, or vesicular. There is no truly natural classification for skin diseases, but for convenience of description I will take them in the following order:

1, Papules. 2, Scales. 3, Vesicles. 4, Pustules.

Papules.—These are small elevations of the cuticle with hardish bases; they do not suppurate or form pus; after a time (sometimes extended) the hardened base declines, a small scale forms, which is not exactly a scab; it rubs off, generally in consequence of some itching, or when it appears on the face by the act of rubbing; it may recur in the same place. There are several kinds of papule: (1) Acne, (2) Strophus, (3) Lichen, (4) Prurigo.

Acne.—This affection is common upon the faces and necks of young people; it is caused by an inflammation of the sadiparous or oil glands, and the tissues immediately adjacent. The sebaceous matter is concreted into a solid form; it distends the excretory duct and even the hair follicle. It then comes into contact with the dirt contained in the air, and forms a black spot on the skin. These are sometimes squeezed out and a thin maggot-like body exudes. Children are wont to describe the victims of this disease under various fanciful names. It is more frequently seen in young men and women just as they approach the age of puberty than in younger children, and usually disappears in the course of a few years. It is more usually met with in those parts of the body which are exposed to the influence of the atmosphere. There are several varieties, as the simple, the indurated, the punctuated, and the form called Acne Rosacea, in which the integument around assumes a livid hue. This last is not often seen in young people; it is more usual in those who, having transgressed the rules of propriety, have their errors discovered later on in life, and whilst the simple forms are easily removed, Acne Rosacea is most intractable.

Treatment.—The simple form may usually be got rid of by a proper application of soap and water, with gentle or vigorous friction, according to the condition of the base of the papule. Friction with sulphur-ointment is useful at times, and in obstinate cases a lotion containing one grain of bichloride of mercury in an ounce of emulsion of bitter almonds will generally remove the complaint. The lotion should be applied at bedtime, a little being rubbed into the orifices of the glands which are faulty. The general health requires attention; fresh air, exercise, attention to diet, and some saline laxative may all be indicated according to the habits of the person affected.

Strophus or Red Gain, or tooth-rash, is a malady affecting infants, and need only be mentioned here; it is closely allied to Lichen; it requires attention to cleanliness, and the removal of causes of intestinal irritation which are common among infants.

Lichen is an eruption of minute papules, reddish in colour, conical in shape; they produce an intolerable itching, and terminate in a branny kind of scale, which causes a shower of debris when the under-garments are changed. There are several varieties, which have distinct names, derived from the shape of the patches, position of the papules, or colour of the neighbouring skin. Lichen tropicus is the prickly heat of the tropics. They all appear usually without any constitutional disorder. They are not common among children, are

often intractable, and can scarcely be cured without the aid of the surgeon; cleanliness, attention to diet, and frequent bathing in waters containing a small quantity of vinegar, one part in 500, is the most useful plan.

Prurigo is characterised by a thickened and discoloured state of the skin, common in old age, unusual in youth; the papules are isolated and scarcely differ in colour from the surrounding cutis. There is a burning itching; it requires medical treatment for its cure.

(To be continued.)

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Anecdotal Natural History.

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AND THEODORE WOOD, M.E.S.,
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No. XVIII.—THE BEAR TRIBE.

PART I.

THE BEARS (*Ursidæ*) are generally considered to form one of the families of the *carnivora*, although, in the strict sense of the word, they are not flesh-eating animals. In their wild state their diet appears to be of a mixed nature, consisting partly of snails and other small creatures, but chiefly of fruit, honey, and roots. They seem but seldom to attack the higher animals, unless when their ordinary food is not to be procured, and, as a general rule, are singularly harmless and inoffensive animals, unless attacked or otherwise annoyed.

In captivity it is found that bears thrive very well upon an exclusively vegetable diet, animal food being seldom or never given to them. The Polar bear, of course, forms an exception to this rule, its natural surroundings rendering it an almost entirely carnivorous animal.

All the bears are plantigrades, that is, the entire sole of the foot is placed upon the ground when the animals are standing or walking. Strange as it may appear, this structure renders them far more capable of assuming an erect position than is the case with any of the monkey family, although the hinder feet of the animals of this latter group approximate so much more closely to those of the human form. Indeed, a bear seems fully as much at ease when standing erect as when upon all fours, and usually assumes an upright position when attacking a foe.

The paws of the bear are armed with long and sharp talons, which, however, are not retractile like those of the animals of the cat tribe. These claws form most terrible weapons when urged by the powerful muscles of the fore-limbs, a bear having been known to scalp a man by a single blow of the paw.

The mode of attack seems invariably to be the same. Approaching to within a short distance of its enemy, the bear halts for a second, rears itself upon its hinder limbs, and delivers a series of terrific blows with the fore-paws, always directing them at the head of its adversary. Should these fail to take effect, it enters upon a different system of attack, and endeavours to seize its foe round the body, and crush him to death by the tremendous pressure of the fore-limbs.

Few animals are more formidable than an enraged bear, no matter of what species, and even an experienced hunter hesitates before encountering one of these animals, except under very favourable conditions. And the animal becomes a more terrible antagonist from its extreme tenacity of life, and from the concentrated energy and fury which it exhibits after receiving a fatal wound, during the last few moments of its existence. Nothing less than a ball through the heart or brain appears to cause instantaneous death, and any less immediately fatal wound appears only to stimulate the animal to fresh and more energetic exertions.

THE first bear upon our list is the Brown Bear (*Ursus Arctos*) of Europe and Asia, an animal with which most of us are more or less familiar. It is a large animal when fully grown, an adult specimen averaging about eight hundred pounds in weight when in good condition.

The fur of this animal is of a uniform brown tint, varying slightly in different individuals. When young a white band is sometimes found encircling the neck of the animal, which, however, almost invariably disappears in the course of two or three years.

The brown bear is tolerably plentiful in the mountainous forests of many parts of Europe and Asia, but in spite of its strength and powers of destruction, is by no means so great a foe to the farmers as might be imagined. Indeed, a cattle-eating bear appears to be the exception and not the rule, the animal generally contenting itself with a vegetable diet, and allowing the flocks to rest in peace.

If, however, the bear should once break through its usual habits, and make a meal upon some cow or sheep, it becomes a confirmed cattle-eater, visiting the folds night after night in order to appease its hunger with the flesh of one of the enclosed animals. In such a case, there is no rest for the farmer until his voracious foe is slain, and his flocks can once more repose in safety from its attacks.

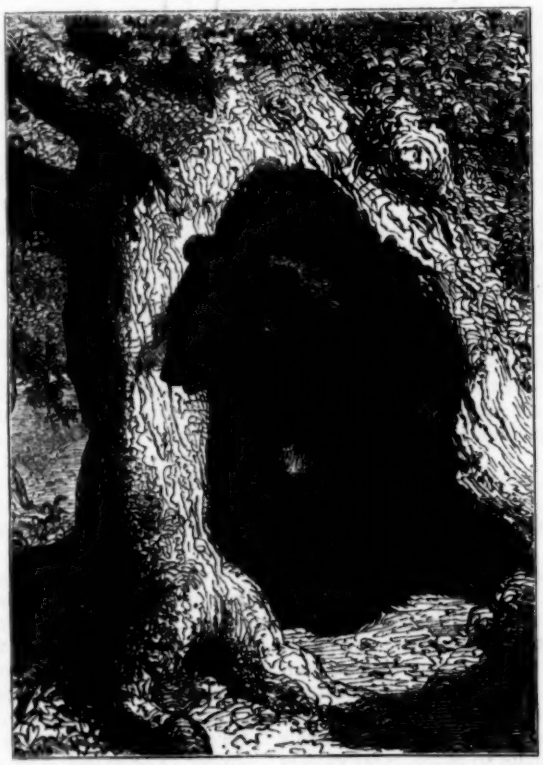
Two very favourite articles of diet with the brown bear are to be found in the insect world, ants furnishing the one, bees the other. Of the former insects the bear is very fond, tearing the nests open with its paws, gathering the ants and their pupæ into its mouth by means of its tongue. Beehives, too, frequently suffer from its attacks, both the insects and their sweet produce being speedily entombed in the body of their destroyer. The animal does not fear their stings, its thick long fur proving an effectual bee-dress. The brown bear affords us a very good instance of perfect hibernation, passing the entire winter in a state of torpor. Towards the autumn, the animal becomes extremely fat, and, about the end of October, sets to work and prepares a suitable chamber in which to pass the chilly months which must intervene before springtime again makes its appearance.

This hiding-place is usually situated among rocks, or beneath the roots of a tree, where the animal will not be exposed to the direct action of the elements. Should such a spot be unattainable, however, the bear constructs a kind of hillock of moss, in which it takes up its abode. In spite of their size, these hillocks are by no means conspicuous, for the deep snow usually conceals every trace of their presence.

Having once fairly entered upon the period of enforced repose, a singular phenomenon takes place in the system of the bear. The stomach and intestines, being

no longer supplied with food, contract very considerably, and the passage is, moreover, blocked by an obstruction, technically known as 'tappen,' so that nothing can possibly pass from the system. This 'tappen' generally consists of pine-leaves, and various substances swallowed by the bear together with the ants of which it is so fond. In constructing its retreat, the bear is very careful of its personal comfort, and carefully lines the floor with a soft bed composed of dried leaves, moss, and other substances of a similar nature.

Secure in its winter retreat, the bear passes the cold months in a state of torpid inaction, subsisting, meanwhile, upon the fat which it has accumulated previous to entering upon its long repose. Yet, strange to say, very little difference is manifested in its condition, for the hunters tell us that if the *hibernaculum* of a bear be opened before the expiration of the winter, the animal is fully as fat and sleek as before it retired to its retreat. The period of inactivity lasts for about five months, the animal returning to the outer world towards the middle of April.



The young of the bear, from one to four in number, are brought forth while their parent is still in her winter retreat, this event usually taking place about the end of January. It is a curious fact that, although at the time of the birth of her cubs, the mother has been deprived of food for upwards of three months, she is yet able to nourish her offspring until the time comes round for her again to make her appearance in the world.

When taken young, the brown bear is easily tamed, and shortly becomes perfectly domesticated, almost as much so, indeed, as a pet dog or cat. Being naturally of a mild and gentle disposition, tame bears of this species have often been allowed to roam about the house with perfect freedom, seldom or never abusing the confidence reposed in them.

This is the animal whose fat, popularly known as "bears'-grease," is, or perhaps was, in such estimation as a means for increasing the growth of hair. The hunters who are necessarily practical naturalists, are aware that the bear, like the squirrel and other hibernating animals, is fattest towards the end of autumn, and consequently they choose that time of year for bear-killing.

I regret to say that the high repute of bears'-grease has been the cause of many frauds. Indeed, if every bear that was killed in any one year were composed entirely of fat, the amount of bears'-grease would not equal the hundredth part of the annual quantity sold in the shops.

My lamented friend, the late Frank Buckland, tells an amusing story of bears'-grease.

Not many years ago, hair-dressers used to advertise the day on which they were going to kill a bear. Readers of Dickens will remember that one of his most humorous stories is founded on this custom. The romantic hair-dresser in question seems, however, to have really slaughtered real bears and sold the genuine fat; whereas, as a rule, no bear was killed, and hogs' lard took the place of bears'-grease.

The hair-dresser in Mr. F. Buckland's story was clever enough to kill the same bear three times weekly. He had one real live bear, which he kept in a cage visible to the public. He had also a skin (head included) of the same kind of bear. On killing days, the bear was withdrawn from the cage, and presently a terrific noise of angry growls, shouts of men, rattling of chains, and so forth, was sure to attract a large crowd. After awhile the proprietor, all flushed and panting came into the shop, and hung up the (apparently) newly flayed skin of the slaughtered bear. Then his cart, with a large box in it, drove off to the docks to fetch another bear. Next morning a fresh bear was to be seen in the cage.

Unfortunately for the ingenious hair-dresser, the secret leaked out unexpectedly. The yells and growls of the wounded bear were produced by a costermonger popularly called 'Leather-mouthed Jemmy,' who was retained to enact the part at a fee of five shillings for each performance. On one occasion he was dissatisfied, quarrelled with his employer, and then the whole ingenious deception was exposed.

The hair-dresser was careful that the new bear should be never quite like its predecessor, and darkened or lightened the hue as required, by the means of blacking and flour. But the bear and the skin were carefully made to agree in hue, and then the latter was greased and streaked with blood before it was hung up.

I have heard of another case where the hair-dresser used to allow his customers to rub their heads against the actual fat of the slain animal as it hung in his shop. The man had a real bear-skin, but used to insert within it the carcass of a large pig which he hired for the day.

THE bear so often mentioned in Scripture belongs to the species known as the Ritck, Dubb, or Syrian Bear *(Ursus Isabellinus)*, an animal which is far from uncommon in the mountainous parts of Palestine. It appears to prefer the summits of the loftiest mountains, being often found even above the line of perpetual snow.

In order that it may be enabled to withstand the extreme cold of its native haunts, the fur is of double thickness, so to speak; a thick covering of woolly fur lying beneath the longer hairs, which alone are visible without close examination. The colour of the fur varies at different periods of the animal's existence, being of a brownish-grey hue while the bear is yet young, and becoming gradually paler as the years roll on, until, when the animal reaches maturity, it is almost white.

The nature of the Syrian bear is remarkably gentle, and it is seldom known to molest a passer-by unless it is attacked or greatly annoyed. It is almost entirely a vegetable feeder, and sometimes causes considerable damage in the plantations in the neighbourhood of its haunts. It feeds by night only, descending from the mountains when darkness sets in, and returning shortly before the break of day.

TURNING to the American continent, we find that it furnishes us with two very well-known bears, namely, the Musquaw, or Black Bear, and the terrible Grizzly.

The first of these *(Ursus Americanus)* is a native of various parts of North America, where, although it is still found in some plenty, it is sensibly decreasing in numbers, owing to the constant attacks of the hunters, who find in the fur and the fat two very valuable articles of commerce. The flesh, also, when properly cooked, is always considered as a great dainty, alike by civilized and savage hunters.

The black bear is an excellent climber, and obtains a large proportion of its food by the exercise of its scandent powers. Few trees will baffle a musquaw when upon the look-out for a wild bees'-nest; and few obstacles will render the saccharine treasures secure when once discovered by the eager and powerful animal. Tooth and claw are alike brought into requisition, and, even if the prize be deeply buried in the hollow of a tree, the bear is sure before very long to tear open a passage, and so obtain the coveted dainty. Success attained, the subsequent proceedings of the bear are of a very summary character, combs, grubs, and perfect insects alike being crammed into the mouth as fast as possible, the animal paying no attention whatever to the remonstrances of the aggrieved owners of the hive.

Quiet and retiring as are its habits when unmolested, the black bear becomes a truly terrible foe when pursued and brought to bay. Launching a shower of tremendous blows with its powerful forepaws at the head of its foe, the animal seems literally carried away with fury, nothing short of a bullet in the heart or brain checking the course of its passion. Many a hunter has perished beneath the claws of an enraged musquaw, which, indeed, when once provoked, seems little inferior in strength and courage to the dreaded grizzly itself.

During the first year of its existence, the fur of the musquaw is of a light grey tint, very different from the glossy black colour which it afterwards assumes. So different is it, indeed, that for many years the young musquaw was thought to belong to a separate species, and was known as the Yellow, or Cinnamon Bear. The fur is shed twice in the year, namely, in spring and autumn.

Like the brown bear of Europe and Asia, the musquaw is accustomed to pass the winter in a state of torpor, concealing itself during the autumn in some snug retreat, where it may be protected from the inclemencies of the weather. Experienced hunters tell us, however, that unless the bear is in good condition when the time for its hibernation arrives it does not trouble itself about a winter retreat, but roams the forest throughout the winter in search of food.

OF all the bear tribe, the terrible Grizzly Bear *(Ursus ferox)* of North America is—with the exception of the Polar bear, which some naturalists will not allow to be a true bear—by far the most savage and powerful. Unlike all the other members of its tribe, except, perhaps, the Polar bear, it will attack a man without receiving the slightest provocation, although, curiously enough, it will not follow up his track. Indeed, the scent of a human being appears to exert a strange influence over the bear, which has more than once been known to relinquish its designs upon a man whom it was proceeding to attack, merely upon experiencing the detested odour.

Should it be wounded, however, the human scent appears to lose its deterrent power, and the animal rushes upon his foe with desperate and reckless fury. Woe betide the hunter if his nerve tremble, and he thereby lose the single chance of a fatal shot which the bear is likely to allow him, for in all probability his doom is sealed.

This solitary opportunity of inflicting a mortal wound is afforded by the habit of the grizzly bear of halting for a second when within a few feet of its victim, in order to rear itself upon its hinder limbs. Should the hunter fail to take advantage of this brief pause, or should he not succeed in inflicting an instantaneously mortal wound, he has but a very slender chance of escaping with life; for the grizzly bear is perhaps even more tenacious of existence than the rest of its kind, and will certainly wreak dire vengeance on its enemy before itself succumbing.

By the native tribes of North America the warlike propensities of the grizzly bear are held in the greatest reverence, and any warrior who is fortunate enough to kill one of these animals in single combat is regarded almost with adoration by his less-favoured comrades. The successful hunter always constructs a necklace from the claws of his slain foe, which he proudly wears, as a visible token of his prowess in the chase. Such a necklace is the equivalent of our Victoria Cross, and it is hardly possible to persuade the owner of such a trophy to part with it on any terms.

A natural dread of the grizzly bear seems to be implanted in the breasts of every animal inhabiting the same land. It is even said that no beast of prey will venture to interfere with the carcase of any creature slain by the bear, even though he may long since have deserted the body of his victim.

Even the most carefully trained horses can scarcely be induced to face the grizzly bear, or 'Ephraim,' as he is generally termed by the hunters; and evince great terror if they are merely required to carry the skin taken from the body of a slaughtered specimen.

A full-grown grizzly bear is a very large animal, weighing from eight to nine hundred pounds, and averaging about eight feet six inches in total length.

It is difficult to obtain a correct idea of the size of an animal merely by a statement of its measurements, and we can scarcely appreciate the huge dimensions of this bear unless we compare it with that of some object with which we are well acquainted. Let us, therefore, by way of illustration, suppose that we have before us a man six feet in height. Now let us take a child of five or six years of age, and stand it erect upon the crown of our man's head. Then let us multiply the girth of his body by three, and cover him with long shaggy hair, and we shall have some little idea of the huge bulk of a grizzly bear as it appears when rearing itself upon its hind legs in readiness for attack.

The paws are of great comparative size, measuring nearly eighteen inches in length, and armed with claws fully five inches long. It is a rather curious fact that the animal possesses the power of separately moving any single claw, without reference to the rest.

These formidable claws are used for various purposes besides those of mere attack and defence, such as digging in the ground for the roots and bulbs which form a considerable part of the diet of the bear, or in burying the carcases of the animals which have fallen victims to their terrible foe.

By their aid, too, the bear is enabled to climb trees, at any rate during the first few years of its life. It would seem, however, that when it attains to adult size, the bulk of the body is too great to be sustained merely by the hold which the claws are able to obtain in the crevices of the bark; many hunters having escaped from an infuriated grizzly bear by ascending some convenient tree, into which their ursine foe made repeated but ineffectual efforts to follow them.

While still young, however, the bear is frequently in the habit of ascending the oak-trees in order to obtain a supply of acorns, which it procures by violently shaking the boughs, and then descending to the ground in order to feast upon the results of its exertions.

Notwithstanding its fierce and savage disposition, the grizzly bear has more than once been tamed; such animals, however, having always been taken while still quite young. Many amusing stories are told of the freaks of these domesticated bears, which, however, seem at the best but rough and rather dangerous pets.

The fur of the grizzly bear is very variable in colour, so much so, indeed, that some writers have considered that there are two separate species included under one name. While the animal is still young, the fur is of a brown colour, with a dark stripe running along the spine. At this period of the animal's existence it is so thick and long that it shakes up and down at every movement of its owner.

In the adult animal, the fur varies in colour from dull brown, irregularly sprinkled with grey hairs, to an uniform greyish white. In the coat of all specimens, however, something is found of the "grizzled" nature from which the animal derives its popular title.

The head is larger in proportion to the size of the body than is the case with bears in general, and the tail is so short as to be completely concealed from view by the long hairs of the hinder quarters.

(To be continued.)

Eminent Practical Teachers.

PESTALOZZI.—(*Conclusion.*)

BY THE REV. CANON WARBURTON, M.A.,

Her Majesty's Inspector of Training Colleges for Schoolmistresses.

VI.

'A MAN should know something about everything, and everything about something.' It was a very shallow retort on the part of a distinguished architect, to whom complaint was made that a building which he had erected was crumbling to pieces from defective materials: 'I am an architect, and not a brick-burner.' A consummate artist is bound to be acquainted with the minutest details involved in his art, and an architect should have learned not only how to burn bricks but to lay them; should be well acquainted with the relative strength and durability of materials, and so ascend through statical certainties and common-places to these grand imaginative conceptions by which monumental structures are raised, and domes 'hung high in air,' defying the assaults of time. Those who have taken the trouble to read the former notices of Pestalozzi in this journal will have seen that he possessed in a remarkable, perhaps in an unequalled degree, the gifts by which children's hearts and sympathies are won. He was never so much at home as when surrounded by a circle of little folks, with a child upon his knee, absorbed in the delightful task of making the acquisition of knowledge delightful. It is in this aspect of his character that 'Father Pestalozzi' is best known and best remembered by his own pupils, and those who have learned from them to love him. But it must not be forgotten that along with all the simplicity and gentle enthusiasm of a village dominie of the old school, Pestalozzi was gifted with a profound and original insight into what may be called the 'metaphysics' of education, and that he speaks when he addresses the world at large with all the authority of a great thinker, and a full confidence in the inspiration of genius.

It was, indeed, a rare combination of gifts! The famous writers on education who preceded him had been, for the most part, philosophers and theorists, and had left to others the practical task of carrying their principles into effect. His own master, Rousseau, after elaborating a scheme for the education of an imaginary son, 'Emile,'* in such affectionate and touching detail, had allowed his own children to be brought up in a foundling hospital. Pestalozzi's strength lay in the two extremes—in an instinctive knowledge of the way to win the confidence and the affections of the individual child, and in deep and far-reaching research into the abstract principles of the science of human culture. To revert to our illustration of the architect, Pestalozzi may indeed be said to have understood the composition of a brick and the way to handle it; in planning lofty and enduring thought-edifices, he was in his element still; but between moulding bricks and designing palaces there lies a whole region of practical activity, skill, and knowledge requisite for success, and in this region he was no better than an old woman or

* See page 3.

a child.* We have his own confession that 'in spite of his grand ideals embracing the destinies of the whole human race, he did not possess the knowledge and ability requisite for conducting a village school.' His life was therefore a succession of failures and disappointments, notwithstanding his rare natural endowments and his single-hearted devotion to the highest and most unselfish objects.

It is important to bear in mind the causes of Pestalozzi's ill-success as a schoolmaster, because that ill-success has brought discredit on his system, and given rise to the idea that it is unsound, or at the best, unpractical—a charge which is sufficiently rebuked by the fact of the survival, or rather the successive revivals, of his principles. On the manner of teaching particular subjects he had little influence, but he compelled the educational world to revise the whole of their task, to take into their purview the ultimate destiny of man and the means of leading him from his youth upwards straight towards that destiny. 'I find the battle raging,' says Pestalozzi, 'about particular and isolated systems of instruction; the mind is filled with fragments of truth, while the very spirit of truth itself is quenched; we have forms, not so much of thinking, as of verbal expressions about what has been thought—forms which suck the blood out of good sense, like a marten that fixes itself on the neck of a poor dove. I put to myself the question, "What would you do if you wanted to give a single child all the theoretical knowledge and practical skill which he requires in order to attend properly to the great concerns of life, and so attain to inward contentment?"'

This passage, taken alone, might almost lead us to suppose that Pestalozzi took such a view of the objects of education as might have commended itself to the mind of an Epicurus or an Antonine, and I have quoted it partly with a view of correcting that impression, and partly because it forms a fitting introduction to the main topic of this article.

It is commonly said, by those who have undertaken to expound the 'Principles of Pestalozzi,' that '*the first of those principles is that education must be religious.*' Now it is quite true that, in common with most men of reflection and intelligence, Pestalozzi held that education without religion loses half its depth and value, and more than half its moulding influence and penetrative power, but to say that religion was 'the leading principle,' or even a 'prominent feature' in his system, involves a grave misconception. Nor would it be quite true, though perhaps it might be nearer to the truth, to say, as some have said, that Pestalozzi was an enthusiast, whose enthusiasm took the form of subordinating everything to intellectual and moral culture; that religion was looked upon by him as 'subsidiary to that end,' and that his endeavour was to 'apply Christianity to the business of education.' The fact is that with him religion is an antecedent condition, a presupposed element, apart from which education would be useless or impossible. It was not so much that religion was to be taught, as that everything was to be taught religiously. Thus, for example, the lessons in natural science and history were to be of such a character, that the child himself could not fail to *infer* the necessity of a Final Cause and an overruling Providence. The works of God were to be successively presented in such vivid and attractive colours to the mind of the learner, that childish wonder should gradually brighten into admiration, and admiration warm into love. And 'there were to be not only religious lessons, but religious influence, and religious example; religion in spirit, in aims, in methods, in associations, in principles, in practice.'

All this is as it should be, but here again Pestalozzi's actual practice fell lamentably short of his ideal. At Yverdun, if we are to believe the testimony of more than one of his own pupils, religion was far too much 'presupposed,' and too little inculcated. Moreover the religion which is said to have 'pervaded the institution' was a religion of the feelings, ignoring the corruption of human nature, ignoring doctrine, almost ignoring Scripture, and deriving no strength or authority from church tradition on the one hand, or from sacramental grace on the other. In fact, Pestalozzi's own religious views were for a long period of his life dim and unsettled in the extreme, and though they cleared and brightened with his advancing age, they were never wholly free from the transcendentalism and indefiniteness which are supposed, rightly or wrongly, to be the characteristic of Teutonic Protestantism. With 'Father Pestalozzi,' as with the aged survivor of the twelve Apostles, religion seemed to resolve itself into the single element of love; but, unlike him, Pestalozzi believed in a natural birth-tendency in the child to what is good and holy, requiring only to be protected in its development from the corrupting influences of the world.

Allusion has already been made to his favourite theory that all education is founded on the relationship which subsists between the infant child and the mother. 'The feelings of gratitude, confidence, and love, in the child towards the mother gradually unfold themselves, and are at a later period transferred by the child, on the admonition of the mother, to God.' To this Dr. Mayo eloquently adds:—'The great means to be employed in moral development Pestalozzi held to be love. The mother's love draws out the child's love; the mother's care and tenderness awaken the first dawnings of faith; the child feels safe in her arms; he confides in her word; what she says he believes, and her will is the law to which he yields, and which he obeys. Thus it is in the mother's arms that the moral character is first developed, and moral education passes its first stage. Rightly to direct and exercise the nascent faculties and sentiments is the next point, and here, God Himself, our Heavenly Father, as early as possible, must be presented as the first object of love, His superintending Providence as the object of faith, and His will as the rule of life.'* A beautiful, we will not say, an *ideal* picture—for, thank God! the experience of most of us will testify that it can be, and has been, realised; but it presupposes the mother—the average mother, be it remembered—as pure and innocent as the new-born child, enfolding it, like an angel, under her wings, and enshrining it safe, in the sanctuary of an unruffled bosom, from all the coarseness and defilements of the outer world. Pestalozzi,

* Speaking of the intended opening of a new educational institution, 'I,' says he, 'was to represent the abbot of the monastery; really, in certain respects, I was more fitted to be the donkey, or, at least, the sheep of the monastery than the abbot. My friends, I speak plainly.'

* In the 'Evening Hours of a Hermit' (see page 67), Pestalozzi says, in language of real beauty, though perhaps of questionable orthodoxy: 'Faith in God is the pure sense of simplicity—the ear of Innocence listening to the voice of Nature proclaiming the Fatherhood of God.'

however, always regarded this idea with peculiar affection, as the first and best of his 'discoveries.' He says, 'I should not anticipate half the consequences for the real benefit of mankind as long as our system failed of extending to the earliest stage of education; and, to succeed in this, we require the co-operation of the most powerful ally of our cause, so far as human power may contribute to an end which Eternal love and wisdom have assigned to the endeavours of man. The object of our ardent desires will never be obtained but through the assistance of the mothers.' Upon this passage, a well-known English Pestalozzian* observes, 'The estimate which Pestalozzi formed of this "prize," the tenacity with which he held it, and the place which he assigned it in his system ought to be thoroughly realised.' It took that undivided possession of his mind which a familiar thought will sometimes acquire from a novel combination. It inspired him with the most sanguine hopes; it was from that moment the nucleus, the luminous centre of all his efforts, and the foundation of his system of moral influence and moral elevation. But in time Pestalozzi became dissatisfied here, and he then made his final discovery. He would carry the parental feeling into the schoolroom, and convert the schoolroom into a home. He saw that the family was the original school—God's model school in the beginning of the world. The trainers of children according to the order of nature are their parents, their brothers and sisters. 'And depend upon it,' he came to assert, 'just so far as we fail to conform the school to a family in spirit and character, it will be imperfect, it will bear the impress of human, not of divine wisdom?' We are justified then in saying that it was one of the first principles of Pestalozzi's system that all *education must be essentially of a parental character.*

(2.) Had we been strictly following the order of importance, the foremost place among Pestalozzi's principles should undoubtedly have been assigned to the next axiom, or 'discovery,' as he would perhaps have called it; which, in fact, underlies all the rest, and has done more to revolutionize our modern systems than the whole of them put together; namely, *All education must be founded upon a knowledge of the nature of the child, and must follow the natural order of the development of the human facu ties.* The artist must be acquainted with the subject-matter of his art, which, in the case of the educator, is the mind of childhood; and 'the study of the mind must form the basis of the science which aims at developing it.' And the true teacher must be not only a mental analyst, but a student of character; for in different individuals tastes and faculties are developed in a different order, and it will be necessary for him to know when to apply to each of them encouragement, or guidance, or restraint. The mind is a living organism with laws of its own, for its growth, nutrition and development; its treatment must be in harmony with these laws. The physician has long since discovered that he can only assist the efforts of nature; the cultivator, that he can create nothing in, can add nothing to, the plant, but only contribute to its proper development by protecting the tender germ from all injurious influences, and by supplying it with the nourishment best suited to assist its growth. So it is with the cultivator of the mind;—and therefore, in selecting the proper nutriment for it, he should attach their relative importance to the different subjects of elementary instruction, not so much for their own sake as for the educative power which they severally possess; he should regard the mind of his pupil not so much in the light of a receptacle for knowledge, as of an instrument which can be made more or less perfect for the acquisition of knowledge for itself.

(3.) The concluding clause of the last Pestalozzian axiom may best be taken in close connection with the next, namely, that *all education must be founded on observation.* Imbued with the materialistic philosophy of the French school, Pestalozzi held strongly, perhaps too strongly, with our own countryman Locke, that *all* human knowledge is derived from the senses. The powers of perception were, therefore, what was first to be cultivated, for the senses themselves cannot be developed without education; we must be taught how to feel, to see, to touch, and to hear; and the child's best first text-book is the world. Examples must be drawn from familiar objects; things must be learned before words; facts and qualities must be apprehended before we attempt to form, or even to learn, definitions. All knowledge is comparatively worthless which is merely bookish and verbal, and not based upon actual experiences, which may be acquired either by the intelligent observation of the individual, or by an abridgment of the natural process, *i.e.*, by a vivid and methodical presentation of the facts to the learner's mind by a skilful teacher. 'In book-learning there is always a danger that the thing signified may not be discerned through the sign. The objects of a child's instruction should constantly be brought under its eyes. So Pestalozzi was careful to devise lessons on 'objects,' in which, by actual contact with the sense, the children were led to discern qualities which they afterwards described in words. To the young, the truth bare before the sight, palpable to the touch, embodied in forms which the senses realize, has a charm which no mere *words* can convey, until they are recognized as the *sign* of the truth which the mind comprehends. In all that relates to the external world the best book is nature with an intelligent teacher. The master who neglects his opportunities of satisfying the intelligence of his pupils on anything that can be made obvious to the sense, must be content to find that when his lessons rise to abstractions he will be gazed upon by vacant faces. The mind will refuse a lively confidence in general truths when it has not been convinced of the existence of the particular facts from which they are derived.'* Thus, then, the teacher, having laid a foundation of fact, apprehended and tested by the senses, advances from the known to the unknown, from the simple to the general, from the concrete to the abstract, never moving a step forward till the preceding foothold is secure,—and the pupil, following his guidance, and having no false steps to retrace, is enabled, without straining his faculties, to arrive at results which might otherwise have been difficult, or slow, or impossible of attainment.

Lastly, *All education is imperfect without due attention to the training and development of the physical powers.* The faculties of the mind are often clouded by bodily disease or by confinement, or even by want of

* Mr. Dunning.

* Sir James Shuttleworth.

proper exercise. Hence the importance of providing suitable apparatus, and setting apart regular times, for gymnastic exercises; of attending to ventilation, light, temperature, wholesome food, and proper clothing—it remained for the English Pestalozzianism of the future to add,—*above all, to cleanliness.*

Such, in rough outline, are the main features of the system of Pestalozzi—the development, natural, progressive, and harmonious, of the intellectual, moral, and physical powers, in an atmosphere of mutual trustfulness and simplicity, under the sunshine of sympathy and love.

If it be asked, as it is fair to ask in the case of a man so respected and renowned, what permanent benefits has Pestalozzi conferred upon mankind? it may fairly be answered—first, that though he may not have been the actual discoverer of the great truths which he enunciated, they were, with him, the fruits of original research. He was the first to popularise them, to bring them down to the public schoolroom, and apply them for the improvement of the masses, and he is, therefore, justly entitled to be called the father of Poor School Education. Again, 'he was the first to define fully and clearly the work of the schoolmaster, to give him the highest aim, and bid him measure his modes of education by it, to inspire him with the right spirit, and enable him to proceed in his work with all the certainty of the light of the science, and give a reason for every part of his procedure.'* Once more, he called attention to the fact that education, to be successful, must aim at assisting the natural expansion of the innate powers of the mind, and this in their proper order of development—that perception, being the earliest born of these powers, must be the first to be cultivated. If he failed to see with sufficient clearness that some truths are in their nature axiomatic, self-evident, and intuitive, and some must rest on authority and the testimony of others, he did good service in making it clear that the great mass of human knowledge is derivable from observation, and only so far trustworthy as it has been, or can be tested and verified by experiment. Lastly, he inculcated by reiterated precept, and still more by example, an almost unlimited belief in the educative power of patience and self-devotion, of trustfulness and sympathy. It is no exaggeration, but the literal truth, that he gave his life for the lambs of the flock.

It is easy enough to find faults in his views, and to call them, as some have done, unscientific, one-sided, and even mutually contradictory; but those who have any acquaintance with the Elementary Schools of to-day will hardly need to be told how completely those views have interpenetrated our modern system, and how beneficial their influence upon it has been. Those results, indeed, it was not granted to Pestalozzi himself to see. Like the dying Lawgiver of Israel, he had led a younger generation to the borders of a Promised Land, into which he was not permitted himself to enter,—and lay down to die amid the apparent collapse of all his undertakings. But he found his consolation in the unshaken hope of the wide future expansion and dissemination of his ideas, in the 'Pisgah-prospect' of the rich inheritance which lay before those who had followed him faithfully through the stony wilderness of his disappointed career. There is, perhaps, nowhere to be found a more affecting memorial of a crushed and bleeding, but still indomitable faith, than the following passage from a letter of Pestalozzi's, which was found among the papers of a friend: 'Let me now for a moment forget my aim and my labours, and abandon myself to the melancholy which comes over me when I remember that I still live, though I am no longer myself. I have lost everything, I have lost myself: nevertheless Thou, O Lord, hast preserved in me the longings of my life, and hast not shattered to pieces before my eyes the aim of my sufferings, as Thou hast shattered the aims of thousands who have corrupted themselves in their own ways. Thou hast preserved to me the work of my life in the midst of my own ruin, and hast caused to arise upon me in my hopeless declining age an evening brightness, and the sight of its loveliness outbalances the sufferings of my life. Lord, I am not worthy of the mercy and faithfulness which Thou hast shown me. Thou alone hast had pity on the trampled worm; Thou alone hast not broken the bruised reed; Thou alone hast not quenched the smoking flax; and hast not to the latest period of my life, turned away Thy face from the offering, which from childhood, I have tried to bring to the forsaken in the land.'

* Mr. Dunning.

'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

Head Master of the Gloucester Road Board School, London.

FOURTH-SCHEDULE SUBJECTS: MECHANICS.

IT is astonishing to see how strong the desire *to make* something or other 'beats in the breasts' of boys. They long to be employed in *doing* something in connection with every lesson that is given. The children seem to have a dislike to sitting still in the desks while the teacher is engaged in performing all the experiments himself at the table. I am afraid this feeling on part of the boys is not sufficiently taken advantage of by us teachers. A short time since a quantity of clay was dug up near the school. Juvenile brickmaking at once commenced. On nearly every doorstep young Israelites were busy at work fashioning bricks and other articles, without either taskmasters or straw; all for the mere love of the thing. They brought some of their work to show me. I at once sent out for some lumps of clay, procured a board, and shaped the plastic material into a landscape, consisting of a range of mountains, plain, table-land, island, inland sea, river basin, etc. Then I told the boys to try and make something like it themselves at home. Brickmaking declined. Art advanced a step. For several days the youngsters continued to bring in more or less artistic representations of a landscape to illustrate geographical terms. They 'made the hills also.' That year the second standard passed well in geography. In fact H.M. Inspectors actually questioned the boys from the clay model. The only drawback was when I found that the young artists proceeded, in time, by the aid of their models, to illustrate things too exalted for them; for, in imitation of Milton's terrific battle of the gods, they tore up the solid hills and hurled them at each other.

It is well to get the boys in Standards V. and VI. to make some simple contrivances to illustrate the mechanical powers. They will, of course, construct their models very roughly; never mind that. A boy will be immensely delighted at being called upon to come to the table, explain his apparatus, and work out some result.

In last month's PRACTICAL TEACHER I gave the outline of the first lesson on the lever, and led the boys to the conclusion that the power applied bears the same relation to the weight or resistance to be overcome, as the length of the weight-arm bears to that of the power-arm.

In the next lesson I proceed to show the other kinds of lever, viz., 1st, when the weight is between the power and the fulcrum; and, 2nd, when the power is between the weight and the fulcrum; the relationship of the several parts to each other in the *three* kinds of levers being always expressed by the proportion:

$$P : W :: \text{w.-a} : \text{p.-a.}$$

to maintain equilibrium. After getting from the boys a good many examples of these various levers, I go on to show the correction necessary when taking the weight of the lever itself into account. This is easily seen in principle by means of the apparatus shown in last month's issue of the PRACTICAL TEACHER. The lever (Fig. 1) weighs exactly 2 lbs. Now if its centre of gravity be placed, say, three distances from the fulcrum, a weight of 2 lbs. on the other side of the fulcrum at three distances will balance. Two or three experiments of a like nature will easily make it clear to the boys that the whole weight of the lever may be considered as collected at its centre of gravity. The boys may now proceed to work examples, thus: If the weight = 20 lbs.; power-arm = 6 ft.; and weight-arm = 1½ feet; find the power?

$$P : W :: \text{w.-a.} : \text{p.-a.}$$
$$P : 20 :: 3 : 12$$
$$\therefore P = \frac{20 \times 3}{12} = 5 \text{ lbs.}$$

The following is an outline of the first lesson upon 'pulleys.' The apparatus stands upon the table in front of the boys.

Has any boy ever seen men lifting things by means of a pulley? Ans.—I have. I saw a man pulling a basket of bricks to the top of a house. I saw some men raising the mast of a barge in the canal. I saw some men getting great boxes out of a ship at London Bridge. Smith, take this in your hand (I give him the pulley S (Fig. 2). What is it? Ans.—A pulley. What is it made up of? Ans.—A wheel in a frame. Can you say anything about the wheel? Ans.—It has a groove in it? Why? Ans.—For the cord to run in. What is there at the lower part of the frame? Ans.—A hook. What is the difference between this pulley (Fig. 2, T) and the one Smith has been handling? Ans.—It is fixed in the frame. If then I call this, T, a fixed pulley, what would you call that, S? Ans.—A movable one. Jones, come and stand on the table. Unhook the cord, T S, from the frame, and take it away from the pulley S. Now put on a 4-lb. weight at P: see what weight on the other end of the cord will balance this. Ans.—4 lbs. Very well. You see then that as 4 lbs. just balances 4 lbs., there is no gain of power by using a fixed pulley. Why do people use it then? Ans.—Because a man can raise a weight to a good height when he stands upon the ground. If he did not use the pulley, how would the man get the basket of bricks that Embery spoke of to the top of the house? Ans.—He would have either to carry them up, or go to the top of the house and pull them up. Just so; and if he did the latter, in what direction would he pull? Ans.—Upward. But *with* the fixed pulley, in what direction does he exert the force or power? Ans.—Downwards. Very good. Cox, write on the board, 'With a fixed pulley there is no gain of power but only a change of direction.' Jones, you can go to your place; French, come out: stand on the table; take this pulley S, pass the cord round it, and hook the cord on to the top of the frame. Now put 2-lb. weight on P: see what weight you must place on the hook at the bottom of this movable pulley S in order to balance. Ans.—4 lbs. Very well; and what part of 4 is 2? Ans.—One-half. Cox, write on the board, 'With one movable pulley the power equals ½ the weight.' Again, French, take off the weight from S; take another movable pulley, R, put the cord on to the hook of S, pass it round R, and hook it up to the top of the frame. Now place a 4-lb. weight on to the hook of R: see what weight at P will balance. Ans.—1 lb. Good; Cox, write on the board: 'With two movable pulleys the power equals a quarter of the weight.' Again, French, take the 4-lb. weight off R, put a cord on the hook, pass it round another movable pulley, Q, and loop it on to the top of the frame. Now hang the 4-lb. weight on to Q (*i.e.* O in Fig. 2); see now what weight a P will balance. Ans.—A half-pound. Exactly so. And what part of 4 lbs. is a half-pound? Ans.—One-eighth. Cox, write on the board: 'With three movable pulleys, the power equals one-eighth of the weight.' Thank you, Cox. You can both go to your places. Tell me what power of 2 is 4? Ans.—The second power. And what power of 2 is 8? Ans.—The third power or cube. Yes. I am now going to rub out what is on the board, and write it down rather differently.

$$\text{With 1 mov. pul. } P = \frac{W}{2}$$
$$\text{,, 2 ,, ,, } P = \frac{W}{2^2}$$
$$\text{,, 3 ,, ,, } P = \frac{W}{2^3}$$

Now can any boy tell me what the power would equal if we had 4 movable pulleys? No answer. Well, look; what is the denominator of the fraction with one movable pulley? Ans.—2. Yes; and we might call that 2 to the first power. What is the denominator with two movable pulleys? Ans.—2 to the second power. (A boy putting up his hand; then several boys). Well? Please, sir, I can tell what it would be if we had four movable pulleys. Could you? What? Ans.—The power would equal the weight divided by 2 to the fourth power. You are quite right. (Another boy.) The power of 2 always equals the number of movable pulleys. Yes, Drayson, you have just hit upon what I wanted. If therefore we let 'n' stand for the number of movable pulleys, come and write on the board what the power would equal in every case. (Drayson writes: $P = \frac{W}{2^n}$.) Very

well. Work this sum, Drayson; if the weight is 120 lbs. and there are three movable pulleys, find the power?

$$P = \frac{W}{2^n};\ P = \frac{120}{2^3} = \frac{120}{8} = 15 \text{ lbs.}$$

You may now take out your exercise books and copy down what is on the board. Copy Drayson's sum as well.

(To be continued.)

How I Teach Swimming.

BY THOMAS GARDNER,

Member of the London Schools Swimming Club.

OF all my school recreations none is more enjoyable and serviceable than the meetings of the Swimming Club. Of its special use in physical training Dr. Carpenter has already spoken in this journal, and I am looking confidently for further words of commendation from the same able pen.

I shall better illustrate 'How I Teach Swimming' by addressing myself to my club or swimming class.

Raising my eyes from my writing, I look out upon a pretty little lake, embowered in shrubberies and plantations. Two islets crowned with noble trees divide its waters. Round and between these green islands light boats are propelled by oars, skimming or splashing according to the skill of the oarsmen. All the year round swans are sailing upon its quiet surface with the perfect grace which accompanies perfect command.

And yet, boys, I am not chatting with you from the 'Lake District,' but from a well-known parish of the largest city in the world. This pretty sheet of water, which is really a greater pleasure to me and mine than we can express, is, in fact, one of three lakes in one of our London parks.

To these lakelets add the numerous enclosed swimming baths, and that noble institution, 'The London Schools Swimming Club,' which is willing and waiting to tell all London boys and girls where and how to swim, and I really begin to think there can be no excuse for any young Londoner, who, at the close of the summer of 1882, has not commenced to practise this useful and healthy, and therefore noble, art. As for my hearty young friends in the country, there's not a single town boy excusing himself for his ignorance in this important matter, who is not perfectly sure that you have every convenience the heart could desire.

With swimming some of my very merriest memories connect themselves, and just as my eyes are refreshed, whenever my pen gives them a minute, by seeing the sun glinting through the trees on the pretty lake, so my mind as gratefully recalls these happy water feats and freaks, these swims far and near, in rivers, and lakes, and seas. Now I am again, in fancy, breasting the tiny waves round Helen's Isle, celebrated by the pen of your favourite writer, Sir Walter. Now, after a long warm pull out from shore, I am taking a header into the clearest, bluest water of the Mediterranean. Now again, nearer home, I am riding on the great storm-waves in the Channel, pitying, as I am borne aloft on a wave-crest, the crowds on the beach who have vainly attempted to dash through the heavy surf. Now I am again, with strong and steady stroke, crossing that most beautiful of Swiss lakes, Lucerne, proud of my two miles' swim under the shadow of the Alps. Nor will my thoughts come home again till they have dwelt for a moment upon a rare battle waged with a torrent in the Pass of St. Gothard.

Better still is the thought of my own and others' lives saved, and strength and vigour daily increased by the regular morning plunge into the little lake before my window.

Really, boys, you *must* learn to swim. You must no longer be without this added pleasure, this increased assurance of your own and others' safety.

You 'have tried and failed'? Be plucky and persevering, and try again. You *will be* men, and overcome all obstacles to your success in life? I heartily hope you may, but be men *now* in this matter. I repeat, swimming is a grand thing, is the best possible exercise, and the most exquisite pleasure, bracing and enlivening both body and mind. By a determined will and persistent effort—if you find it is required—gain this good thing. At the 1880 meeting of the London Schools Swimming Club, two lads from my small school carried off the fourth and eighth prizes, and proud enough they were to receive them from the hands of a Royal Duke; while at the last competition one of my most regular and persevering pupils fought his way through heat after heat to the coveted position of champion for the year; the competitors on each occasion numbering between two and three hundred. But far truer encouragement for me as a teacher, and for you as learners, is afforded by the fact that not one whom I have presented for competition has failed to obtain his swimming certificate. What hundreds have done, thousands can do. Make a trial in the present warm weather; or if you have failed, try again; and in this column, kindly placed at our disposal, I will give you the very best and most practical help that my pen can afford.

First Lesson.

'Well done, lads! all here but Jones, and the chimes from St. Mark's announcing the hour of seven, with dear old "Home, Sweet Home." Oh, Jones, Jones, you'll learn as little of swimming as of anything else if you are not more punctual. Is this not as pretty a little lake of clear fresh water as one need wish—better than the best covered bath for such hearty lads? Nay, Smart and Quickly, not quite so fast. You must not remain too long in the water on your first visit, and I wish to show you how easy the whole thing is, so keep your clothes on till I have plunged in; then undress as smartly as possible, watching my movements at the same time.'

While undressing all are standing round eagerly listening to my hints on diving. Fortunately we have a long, broad plank attached to wheels, which is pushed out till plank and water are at the same level. A still longer plank at right angles to the first does duty as shaft and running board. After a lesson or two how that long elastic plank and diving board will vibrate as the lithe, happy forms run and leap into the lake. On this first occasion, however, they are instructed to walk on the diving board and attempt a standing dive.

As I am to be their exemplar in all things I, too, must deny myself the usual rush, and, standing on

the plank, put into practice the hints I have just given. I need not demand attention, all are intently observing, as I bend my body well over my knees which are bent at right angles, and with palms together extend my arms straight before my head and towards the water. Very deliberately, that all may have ample time for observation, the head and hands are brought nearer and nearer to the water, until the preservation of equilibrium becomes a difficult problem. I then quietly slide into the water, the feet remaining on the platform as long as possible. No sooner am I in the water than, according to instruction previously given, my back, head, and hands, before curving and pointing downwards, are bent upwards, and my head is out of the water again almost before the feet are in.

This was to be the signal for undressing, which operation at once rapidly proceeds, while I introduce to the young gentlemen's notice some of the simpler water-feats. 'Oh, Smart! how easy!' says Trickster. 'Master's simply lying on his back and doing nothing at all; there now, he's swimming on his chest and getting along, though arms and legs move quite slowly, and see, now he's on his side gliding through the water at a rare pace. Oh! nothing could be easier.' And down goes Trickster on the grass, trying all the strokes at the same time, much to his own satisfaction and his companions' amusement. Fisher, Codling, and Waterman, three of last season's pupils are undressed first, and join me for a few moments, before the rest receive orders; the fresh men getting encouragement and confidence from seeing their playmates almost as much at home in the lake as their master.

All are ready, Smart and Trickster quite impatient for their first attempt.

'Now, lads, just a word. Trust yourselves entirely to us. We shall *play no tricks* with you. My young assistants will be just as careful as myself in that matter. I should like you all to dive in from the plank. Smithers and Spratling, jun., a little nervous? Well, run in sharply, and well wet your head. We must go and see that the divers come to their feet comfortably.'

Those first 'dives' could only by special courtesy be so called. Fat, heavy Slocomb plumped into the water with wondrous sound and splash, while Trickster, after exaggerating my diving posture, and adding a funny little jump, altogether unauthorised, turned a complete somersault, and fell upon his back, far too much flurried to try the strokes he had been practising on the grass.

The 'divers' being put upright again—Slocomb being urged to try and bend his body, and Trickster not to twist and throw himself about so wildly—we promise a speedy repetition of the diving lesson; and Fisher, Codling, Waterman, and myself betake ourselves to the younger and more timid pupils, and coax and help them into deeper water. The rest are ordered to keep moving while they watch our proceedings, and we give our first lesson on

FLOATING.

I take the most timid, lay him on his back, placing one hand under the centre of his body; bid him extend his arms straight behind his head, with palms turned upwards, the legs lying upon the water together, equally straight, with the toes pointing outward. Now, my last order being obeyed, and the chest thoroughly inflated, my pupil, who is rapidly gaining confidence, is assured that I can scarcely feel his weight. On the gradual withdrawal of the supporting hand he almost floats, unless timidity returns. One of the elder pupils is called, and is surprised to find how little weight he has to support while keeping his junior afloat; and the little man, finding his feet, and having lost much of his timidity, has one good splash, a smart run on the bank, a brisk rub down, and, having rapidly dressed, feels 'as warm as a toast.'

My patient young assistants have been following me step by step, their instructions being accompanied by further hints and assuring words from myself. Our attention is then turned to the bigger boys, and not infrequently one or two can float after the first lesson.

Diving and *Floating* have thus occupied our first necessarily short lesson, which has not been of ten minutes' duration.

Tuesday, Thursday, and Saturday are our mornings for swimming, and Thursday finds my pupils on the bank before the stroke of seven for their

SECOND LESSON.

Even Jones has been so aroused by the enthusiastic reports of progress that he is early as the rest. Looking round, however, I find to my astonishment that Trickster is not with us. Smart, his *alter ego*, had of course called for him, and reported him laid up with a very bad cold. 'He came yesterday morning, sir, and stayed in the water twenty minutes,' is information which at once accounts for his bad cold. Poor Trickster! I assured him three mornings would be quite sufficient for the present, that more than five or ten minutes in fresh water would be more likely to do him harm than good; and now he has very likely robbed himself of several lessons.

Again I and my assistants undress first. I utilize the time thus employed in repeating the diving and floating hints of the last lesson. The greater number dive in, and dive better. The bigger ones try to float unaided, while we rehearse the floating lesson with the younger pupils. This done, they are ready for the next step. Still lying upon the back, and supported as before, they are—having first seen the thing done by all four teachers—told to draw up the legs and strike them out again, and are rejoiced to feel themselves really moving. Then they are taught to sweep the hands round to the side, and afterwards to use arms and legs together. This is quite sufficient for the more delicate lads, who watch the subsequent proceedings while dressing. The more robust, however, remain a minute or two longer, to receive their first lesson on the

BREAST STROKE.

They are taken out from the shore till the water is shoulder-high, and there stand with faces towards land. '*Heads well back between the shoulders;*' '*Spine well curved backwards,*' are the first orders; and as they are of the utmost importance, it will pay to secure for them most careful attention. Here I pursue a method I have found adopted in some German schools of natation, which has this special excellence, that by it a considerable number may be simultaneously put

through a swimming drill. The execution of two orders completes the movement of the arms, while the stroke of the legs is divided into three movements. Insisting on attention to previous instructions as to back and head, and seeing that the arms of all are stretched out, with hands just beneath the surface of the water, the thumbs touching, the palms downwards, I give the orders, '*One*,' '*Two*.' At '*One*' the arms are swept round at full length, till they make a straight line with the shoulders, the elbows being then bent, and the hands brought together under the chin. At '*Two*' the arms are stretched quickly forward to the first position.

During this drill I always find some simply skimming the water in their outward sweep, others ploughing too deeply. Be careful the hands commence the outward sweep just beneath the surface, and strike slightly downwards. Smart and Quickly, who have already almost learnt the stroke, are somewhat inconvenienced by being carried forward and off their feet, and are a little flurried till they find that if they keep cool their feet will quietly take their accustomed places; being on the other hand delighted with this additional proof of the buoyancy of the water, and the assurance that they only want the leg stroke to enable them to swim. But our budding natators have been in nearly ten minutes.

THE LEG STROKE

we therefore reserve for the

THIRD LESSON.

Of course our smaller pupils, who in lesson two were not put through the drill for arms, were carefully watching the process, and can soon take their part with the rest in this comparatively easy feat. And now comes what, in my somewhat extensive experience as a voluntary teacher of swimming, I have generally found the crucial test of a boy's natural aptness or otherwise, and the teacher's patience—

'THE LEG DRILL.'

Our plank is wheeled out a trifle further, or a stout rope is held by three assistants, one in the centre, and one at either end.

With chests upon rope (grasped, of course, by the hands, which are held close to the chest), or better still, upon the plank, and at such a level that the water just covers the shoulders, alumni are ready for orders. 'Backs curved, heads well back,' is repeated, and with legs making a straight line with the body, the feet being some six inches under water, first position for leg drill is taken, and orders '*One*,' '*Two*,' '*Three*,' are given. They have been previously explained. At '*One*' the legs are to be drawn quietly under, with knees widely apart, and toes pointing outwards; at '*Two*' strike out the legs quickly at the greatest possible angle, the toes still pointing well outwards; at '*Three*' bring the legs stiffly and quickly together, and thus return to first position. Some of the pupils will doubtless, during the first attempts, be kicking about with feet in some cases actually out of the water; others have to be told not to strike so deeply. The importance of creating the largest possible wedge of water by striking out at the widest angle, and of utilizing this wedge by bringing the legs smartly together, is especially insisted upon and exemplified. Now are orders '*Two*' and '*Three*' included under '*Two*,' so that *the movements of arms and legs may be taken simultaneously.* This simultaneous drill for arms and legs is proceeded with in the case of the most apt only. The rest indulge in their grand final splash and race along the bank; then while dressing note and criticise the proceedings of the 'first division.'

The more forward lads—amongst whom, of course, are Smart and Quickly, poor Trickster being still away—make a line of horizontal bodies on the plank, and arms and legs are moving so well together that some delicious confusion is experienced, for the chest slips over the plank, and the lads are actually swimming.

Rapidly they are replaced, and secured by a belt, broad and soft, to the plank, and after the orders '*One*' and '*Two*' have been called, and their performance criticised twice or thrice, a good lesson is over. At lesson four the same process is repeated with the more awkward squad, division one receiving more of individual attention. The hand by which they are at first supported is soon not required, or the rope and belt by which others are suspended from the platform is gradually lowered, and at this fourth lesson several lads can swim,—have done much towards acquiring for life this exhilarating and useful accomplishment. Even breathing and a long, steady stroke they will soon acquire, and the smarter, more rapid, and ornamental styles, with tricks and games without number, will follow as a matter of course.

(To be continued.)

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Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the questions have been set.*]

Arithmetic.

STANDARD I.—(*sums dictated*).

(1) 562 + 784 + 305 + 476 + 247 = Ans. 2374.
(2) 463 + 740 + 857 + 384 + 236 = Ans. 2680.
(3) 5070 − 2087 = Ans. 2983.
(4) 6005 − 3047 = Ans. 2958.

STANDARD II.—(*sums dictated*).

(1) 70,604 + 9,005 + 25,493 + 840 + 68,754 + 5,070 + 7,309 = Ans. 187,075.
(2) 70,650 − 19,949 = Ans. 50,701.
(3) 677,567 ÷ 8 = Ans. 84,695 − 7.
(4) 79,685 × 708 = Ans. 56,416,980.

STANDARD III.—(*sums dictated*).

(1) Add £74 19s. 7½d., 18s. 11¾d., £960 7s. 3d., £8 0s. 5¾d., £409 12s. 9d., 8s. 6¼d., £37 16s. 8½d. Ans. £1,492 4s. 3¾d.
(2) Subtraction:
£600,705 19s. 4¼d. − £10,879 19s. 11d.
= Ans. £589,825 19s. 5¼d.
(3) Long Division:
19,115,680 ÷ 97. Ans. 197,068 − 84.

(4) Question (written on black board): 'A person has 4 five-pound notes in his purse. If he pay the butcher £7 9s. 11d., and the baker £8 9s. 9½d. what sum will he have left?' Ans. £4 0s. 3½d.

STANDARD IV.—(*written on black-board and given alternately.*)

A. (1) Reduce 3ac. 2rds. 16pls. to square feet.
Ans. 156,816 sq. ft.
(2) What is the cost of 89 tons of coals at 18s. 11d. per ton? Ans £84 3s. 7d.
(3) If a brick weighs 64 ounces, find the weight in tons, etc., of 15,000 bricks.
Ans. 26 tons, 15 cwt. 2 qr. 24 lbs.
(4) Two tubs of butter, one containing 2cwt. 84lbs. the other 1 cwt. 3 qrs. 6 lbs., are sold for £20 14s. 4½d., how much is that per lb.?
Ans. 9¾d

B. (1) A man bought 39 horses for £1,364 0s. 6d., find the cost of each. Ans. £34 19s. 6d.
(2) What will be the cost of 29,000 feet of gas at 2s. 11¾d. for 1,000 feet? Ans. £4 6s. 4¾d.
(3) How many square feet are there in a field containing 4 acres 3 rds. 12 pls.?
Ans. 210,177 sq. ft.
(4) What will be the weight in tons, etc., of 571 bags of potatoes, if each bag weigh 168 lbs.?
Ans. 38 tons 15 cwt. 2 qr.

STANDARD V.—(*written on blackboard*).

(1) What will a farmer pay for two fields, one containing 9 ac. 3 rds. 26 pls. and the other twice as much at £3 19s. 0d. per acre? Ans. £117 9s. $3\frac{3}{10}$ d.
(2) If 2 cwt. 3 qrs. 5 lbs. cost 4s. 6d. how many tons can I buy for £13 12s. 4d.?
Ans. 8 tons 9 cwt. $14\frac{81}{97}$ lbs.
(3) Bill:
$33\frac{1}{4}$ lbs. of tea at 4s. per lb.
$78\frac{1}{2}$ „ coffee at 1s. 4d. per lb.
$57\frac{3}{4}$ „ cocoa at 1s. 8d. „
$28\frac{1}{2}$ „ mustard at 1s. 10d. per lb.
42 eggs at 3 for 4½d. Ans. £19 11s. 5d.

STANDARD VI.—(*written on black board*).

(1) Multiply 2·564 by 3·048 and divide the result by ·04 × 72·5. Ans. 2·69485.
(2) Find the difference between $\frac{3}{8}$ of $\frac{4}{5}$ of 10 guineas and $2\frac{1}{2} + 3\frac{1}{4}$ of £5. Ans. £25 12s.
(3) If 80 men made a street in 7 days how many men could make a street twice as long in 9 days?
Ans. $124\frac{4}{9}$.
(4) If $\frac{3}{4}$ of $\frac{2}{3}$ of a share be worth £$24\frac{1}{2}$, what will be the value of $14\frac{7}{10}$ shares? Ans. £570 7s. $2\frac{2}{5}$d.

Dictation.

STANDARD I.

(1) *Transcription*: Winter has come at last. There are no flowers now in the garden and every leaf is gone from the trees.
(2) *Dictation*: The old mouse ran through the long grass to her hole near the roots of that great tree.—*Royal Readers*, No. 1.

STANDARD II.

At last the fairy, who knew what they thought, was angry with them, and she meant to punish their discontent by granting their wishes, and making the folly of these two little trout an example to all the foolish fish in the world. So one day she called the three silver trout to her.—*Progressive Reader*, *p.* 81.

STANDARD III.

Her attention was attracted by a beautiful little fawn that seemed too young to run about, and which stood timidly gazing at the child with its soft, dark eyes. The girl moved towards it; but the fawn started back, with a frightened look and fled. The child gave chase; but the fawn was soon hid among the tall reads and grass of the jungle.—*Royal Readers*, No. 3, p. 75.

STANDARD IV.

'They saw the vault covered, and the stone fixed down: then, when the dusk of evening had come on and not a sound disturbed the sacred stillness of the place—when the bright moon poured in her light on tomb, and monument, on pillar, wall and arch, and most of all (it seemed to them) upon her quiet grave—in that calm time when all outward things and inward thoughts teemed with assurances of immortality, and worldly hopes and pleasure humbled in the dust before them—then with tranquil and submissive hearts, they turned away and left the child with God.'—*Dickens.*

STANDARDS V. AND VI.

'Amidst the crowd, as it streamed saunteringly along, were two spectators—strangers to the place as was notably proved by the attention they excited, and the broad jokes their dress and appearance provoked from the rustic wits—which they took with amused good humour and sometimes retaliated with a zest which had already made them very popular personages indeed; there was that about them which propitiated liking. They were young and the freshness of enjoyment was so visible in their faces that it begot a sympathy, and wherever they went, other faces brightened around them.'—*Bulwer Lytton.*

Grammar.

STANDARD II.

Write out the nouns, and verbs from your dictation.

STANDARD III.

Write out the nouns, verbs, adjectives, adverbs and pronouns from your dictation.

STANDARDS IV. AND V.

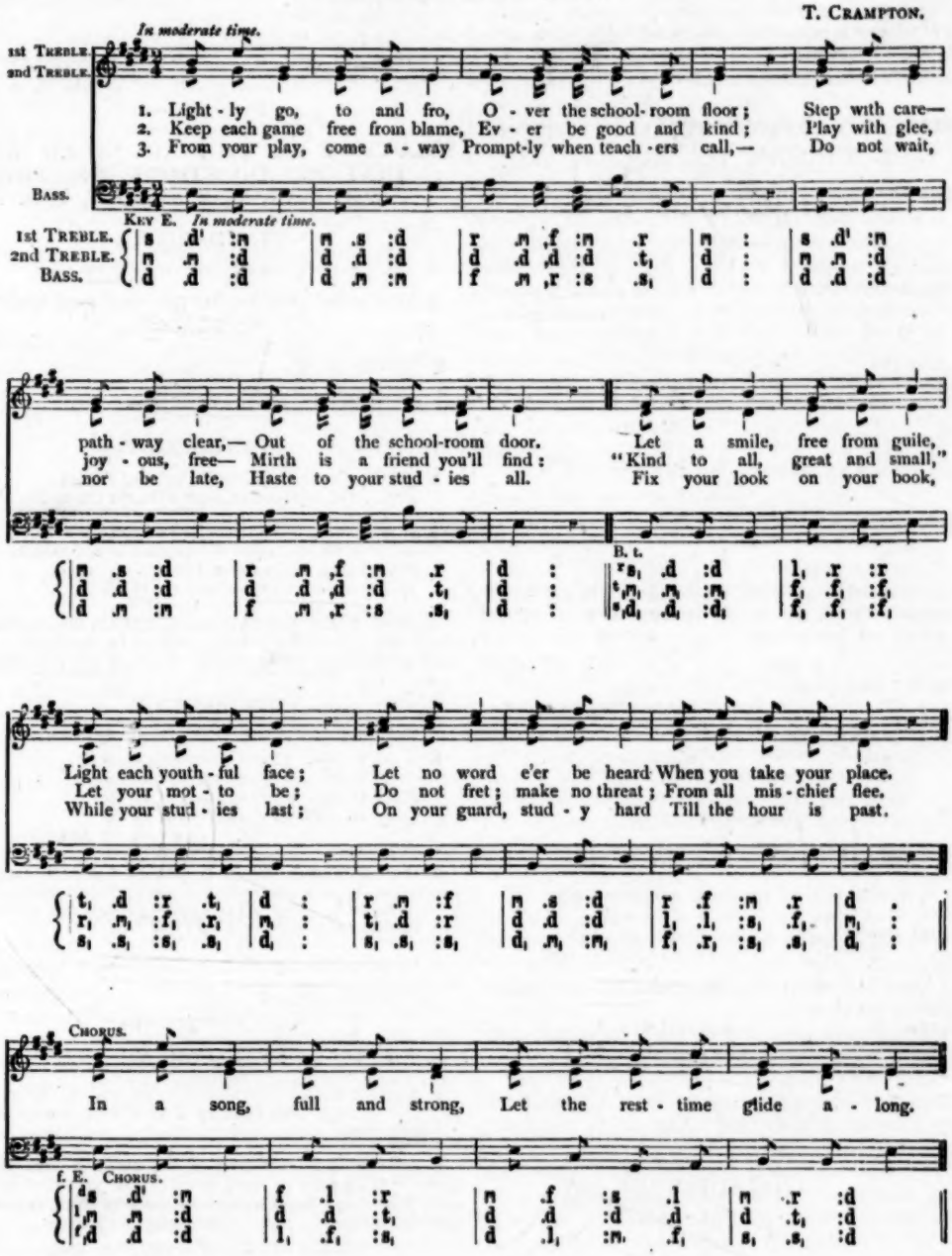
Parsing:
A. The ploughman homewards wends his weary way.
B. The forests with their myriad tongues shouted of liberty.
C. Against the walls of the cottage hung two dry skins.

STANDARD VI.

Analyse and parse:
Look, how the lion of the sea lifts up his ancient crown.

LIGHTLY GO!

T. CRAMPTON.


In moderate time.
1st TREBLE.
2nd TREBLE.
1. Light - ly go, to and fro, O - ver the school- room floor; Step with care—
2. Keep each game free from blame, Ev - er be good and kind; Play with glee,
3. From your play, come a - way Prompt-ly when teach - ers call,— Do not wait,
BASS.
KEY E. In moderate time.
1st TREBLE.
2nd TREBLE.
BASS.
path - way clear,— Out of the school-room door. Let a smile, free from guile,
joy - ous, free— Mirth is a friend you'll find: "Kind to all, great and small,"
nor be late, Haste to your stud - ies all. Fix your look on your book,
B. t.
Light each youth - ful face; Let no word e'er be heard When you take your place.
Let your mot - to be; Do not fret; make no threat; From all mis - chief flee.
While your stud - ies last; On your guard, stud - y hard Till the hour is past.
CHORUS.
In a song, full and strong, Let the rest - time glide a - long.
f. E. CHORUS.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR AUGUST, 1882.

EXERCISE IX.

(1) $abxy$, $abcxyz$, mn, $abcpqr$. (2) a^9, x^7, a^5b^5, $b^3d^4e^3$. (3) xy^2z^2, ab^3c^2x, abx^4y^4. (4) $21a^2b^3$, $90x^3yz^2$, $480m^2n$. (5) x^8y^2z, $-40ab^3c$, $-30a^2b^2c$. (6) $300a^3b^4c^2x$. (7) $4abx$ letters. (8) $240x$ pence.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR AUGUST, 1882.

STANDARD III.

A. 1. 568—8.
2. 607—10.
3. 6522—21.

B. 1. 804—68.
2. 4982—102.
3. 12,363—180.

C. 1. 4194—68.
2. £3816 12s. 3½d.
3. £4377 8s. 10d.

D. 1. £672 15s.
2. 4239—1277.
3. 124—1664.

E. 1. £2306 13s. 8½d.
2. £8517 2s. 0½d.
3. 2,061,108 twopences.

F. 1. 4,860,734 farthings.
2. £3973 8s.
3. 2477—110.

ADVANCED EXAMINATION.

1. £187 10s.
2. 8 pears.
3. 615,176,443 farthings.

STANDARD IV.

A. 1. £798 1s.
2. £20,285 0s. 3¾d.
3. £612 10s. 6½d.

B. 1. £84,262 14s.
2. £273,563 15s.
3. 601,920 inches.

C. 1. 188 ton 6 cwt. 2 qr. 27 lb.
2. 43,197 square yards.
3. £78 15s.

D. 1. £24,797 18s. 11½d.
2. £428 19s. 0½d.—204.
3. £1 8s. 6d.

E. 1. 555,060 seconds.
2. 83d. 3h. 38m. 1⅗s.
3. 17s. 1½d.—130.

F. 1. 249 cwt. 3 qr. 15 lb. 9 oz. 15 dr.
2. 150 dozen.
3. 16,833 lb. 7 oz. 3 dwt. 23 gr.

ADVANCED EXAMINATION.

1. 2 ton 20 lb.
2. £25.
3. 356 dresses, 5½ yds. left.

STANDARD V.

A. 1. £12 13s. 5½d.
2. £44 3s. 2⅔d.
3. £85 3s. 5½d.

B. 1. £127 1s. 10½d.
2. £347 4s. 10½d.
3. £1220 10s. 6¾d.

C. 1. £7285 9s. 8½d.
2. £33,907 19s. 2d.
3. £82 5s. 1$\frac{113}{144}$d.

D. 1. £13 2s. 6d.
2. £953,940 0s. 4¼d.
3. £881 19s. 0$\frac{7}{10}$d.

E. 1. £10 5s. 6½d.
2. £33 5s. 1⅞d.
3. £4640 12s. 6d.

F. 1. £2 1s. 5½d.
2. £27 12s. 6½d.
3. £12,590 8s. 6¾d.

ADVANCED EXAMINATION.

1. £5371 15s.
2. £1 5s.
3. £6981 2s. 7$\frac{11}{12}$d.

STANDARD VI.

A. 1. $3\frac{8}{9}$.
2. $3\frac{1}{15}$.
3. $\frac{1}{144}$.

B. 1. 2·887125.
2. ·01606.
3. ·066875.

C. 1. 4½ days.
2. £6 17s. 6d.
3. 4s. 9$\frac{1}{10}$d.

D. 1. $24\frac{1}{2}$.
2. £80 18s. 9d.
3. $4\frac{1}{11}$.

E. 1. £16 19s. 6$\frac{8}{11}$d.
2. £51 14s. 6$\frac{7}{11}$d.
3. ·000005078125.

F. 1. $\frac{2}{3}\frac{1}{3}\frac{1}{3}$.
2. $\frac{3}{8}\frac{3}{8}$.
3. £1 10s.

ADVANCED EXAMINATION.

1. 45$\frac{5}{7}$ days.
2. 10,$\frac{8}{1}\frac{8}{4}\frac{8}{7}$ hours.
3. $\frac{1}{2}\frac{1}{3}\frac{1}{4}$.

STANDARD VII.

A. 1. £284.
2. £101 14s. 3⅗d.
3. 3$\frac{1}{12}$ per cent.

B. 1. 327.
2. £4 4s. 9$\frac{6}{10}$d.
3. 4$\frac{1}{11}$ years.

C. 1. £148 1s. 6$\frac{3}{4}$d.
2. £135 19s. 0$\frac{2}{3}$d.
3. £869 16s. 8d.

D. 1. £377 15s. 6¾d.
2. 649.
3. £27 6s. 4½d.

E. 1. 29$\frac{13}{88}$ per cent.
2. £6766 13s. 4d.
3. £7 5s. 7$\frac{8}{11}$d.

F. 1. 9$\frac{1}{11}$ days.
2. £10 3s. 4$\frac{1}{10}$$\frac{1}{10}$d.
3. 14$\frac{7}{8}$ loss.

ADVANCED EXAMINATION.

1. 150 scholars.
2. £25 1s. 11$\frac{1}{11}$d. increase.
3. 179·067+yards.

SOLUTIONS OF THE 'ADVANCED EXAMINATION' QUESTIONS IN THE SCHOLAR,' FOR AUGUST, 1882.

STANDARD III.

1. 1½d. × 200 × 7½ × 24 = 45,000d. = £187 10s. Ans.

2. ½ sov. = 120d., and 6 × 120 = 720, no. of pears bought.
720 ÷ 90 = 8 pears each. Ans.

3.

£	s.	d.
701,723	14	8½
60,914	18	9¾
640,808	15	10¼

= 615,176,443f. Ans.

STANDARD IV.

1. £600 + £150 = £750, selling price of the tea.
£750 ÷ 2½d. = 36,000 oz. = 4500 lbs. = 2 ton 20 lbs. Ans.

2. 25s. ÷ 20 = 1s. 3d., value of one pigeon.
1s. 3d. × 8 = 10s., value of 8 pigeons or of 6 rabbits.
10s. ÷ 6 = 1s. 8d., value of 1 rabbit.
1s. 8d. or 20d. × 300 = 6000d. = £25. Ans.

3. 36 yd. 3 qr. 3 nl. = 591 nls., × 64 = 37,824 nls., total length. And 6 yd. 2 qr. 2 nl. = 106 nls., required for one dress. Hence 37,824 ÷ 106 = 356 dresses and 88 nls., or 5½ yds. left. Ans.

STANDARD V.

1.

		£	s.	d.
1s. 8½d.	× 240 × 50 =	1025	0	0
1s. 9d.	× 230 × 84 =	1690	10	0
1s. 7½d.	× 200 × 70 =	1137	10	0
1s. 10½d.	× 180 × 90 =	1518	15	0
		£5371	15	0 Ans.

2. (6s. + 4s. = 10s.) × 20 = £10, and 4s. × 40 = £8, total £18, excess that the men and women in the aggregate receive over a boy's share each. Then £163 − £18 = £150, which, divided by 120, the number of recipients = £1 5s. Ans.

3. Bringing both the areas to half-roods, and, working by simple proportion, we have—

$$\frac{£2170\ 15s. \times 1206}{375} = £6981\ 2s.\ 7\tfrac{1}{11}d.\ \text{Ans.}$$

STANDARD VI.

1. A and B do $\frac{1}{12}$ of the work in a day, and A, B, and C do $\frac{3}{76}$; $\frac{3}{76} - \frac{1}{12} = \frac{1}{228}$ part done by C in a day, hence 228 ÷ 5 = 45$\frac{3}{5}$ days. Ans

2. After a little consideration the question thus presents itself:—'If 1¾ miles be made by 50 men in 30 days of 10 hours each, how many hours a day must 52 men work to make 1¼ miles in 20 days?' Then by proportion we have—

$$\frac{10\ \text{hrs.} \times 5 \times 50 \times 30}{7 \times 52 \times 20} = 10\tfrac{10}{13}\ \text{hrs.}\ \text{Ans.}$$

3. $6\frac{3}{4} - 4\frac{5}{8} = 2\frac{1}{8} = \frac{17}{8}$; $(8\frac{3}{8} \div 12\frac{1}{2}) = (\frac{67}{8} \div \frac{25}{2}) = (\frac{67}{8} \times \frac{2}{25}) = \frac{134}{200}$; $(\frac{17}{8} \div \frac{134}{200}) = \frac{17}{8} \times \frac{200}{134} = \frac{425}{268}$, the first term simplified. $(9\frac{1}{8} \times 3\frac{7}{8}) = (\frac{73}{8} \times \frac{31}{8}) = \frac{2263}{64}$; $7\frac{3}{16} + 3\frac{7}{8} = 11\frac{1}{16} = \frac{177}{16}$; $(\frac{2263}{64} \div \frac{177}{16}) = \frac{2263}{64} \times \frac{16}{177} = \frac{2263}{708}$, the second term. Then $(\frac{425}{268} \div \frac{2263}{708}) = (\frac{1275}{804} \div \frac{2263}{708}) = (\frac{1275}{804} \times \frac{708}{2263}) = \frac{902700}{1818252} = \frac{225675}{454563}$. Ans.

STANDARD VII.

1. 20+24+26=70 per cent. in first three classes, hence 30 per cent. must be in the fourth class; but there are 45 scholars in this class, hence 45÷30=1½, one per cent. of the scholars, and 1½×100=150. Ans.

2. £3×45=£135 yearly interest before transfer.
£92·5×45=£4162·5, amount received on selling out.
£4162½÷260=16 1/16 cents. of bank stock bought, and
£10×16 1/16=£160 5/8 income from bank stock, hence
£160 5/8 − £135=£25 5/8=£25 1s. 11 1/4 increase. Ans.

3. 6 ac. 2 r. 20 p.=32,065 sq. yds., the sq. root of which=179·067+yards. Ans.

—o—

Practical Lessons on Insect Life.

BY THEODORE WOOD, M.E.S.,

Joint Author of 'The Field Naturalist's Handbook.'

NO. XIV.—THE HETEROPTERA.

THE *Heteroptera*, or, according to some systems, the *Hemiptera-Heteroptera*, differ from the *Homoptera* chiefly in the structure of the wings, which, in those species that possess them, are of two different textures, the basal portion of each being hard and leathery, while the remainder is membranous and semi-transparent. Hence is derived the title of Heteroptera, which signifies 'different-winged.'

In the *Heteroptera*, the wings slightly overlap when the insect is at rest, instead of running parallel to one another at the suture, as is the case with the *Homoptera*.

Amongst the other distinguishing features of the group, we may mention the form of the body, which is flattened, and not convex, and also the position of the proboscis, which starts from the front of the under surface of the head, instead of from the back.

In many of the *Heteroptera* the wings are scarcely visible, being, indeed, nothing more than mere rudiments of those organs, while in others they are only developed in a very slight degree, and are utterly useless for purposes of flight. In some species we meet with a rather curious phenomenon, the vast majority of specimens being apterous, while an example occasionally appears in which the wings are fully developed.

The *Heteroptera* are sub-divided into two great groups, known respectively as *Gymnocerata* and *Cryptocerata*. The former of these titles signifies, 'apparent-horned,' and refers to the antennæ, which, in the insects belonging to this group, are long, and are easily seen. This is not the case, however, with the members of the second group, in which the antennæ are very small, and are not visible except upon close examination. The title of *Cryptocerata*, or 'hidden-horned,' which has been applied to them, is, therefore, very appropriate.

In Mr. Westwood's arrangement these two groups are termed *Aurocorisa* and *Hydrocorisa*. The former of these two titles signifies 'air-bugs,' all the insects of the group being dwellers either upon the earth or the surface of the water, beneath the surface of which, however, they are not in the habit of living. But the *Hydrocorisa*, or 'water-bugs,' are all inhabitants of the water itself, passing the greater portion of their existence beneath the surface, and only rising occasionally in order to obtain a supply of air.

A very conspicuous member of the former group is the insect scientifically known as *Tropicoris rufipes*, but which possesses no popular title. In common with many of its congeners, however, it is often termed a 'Bishop's Mitre,' in consequence of the peculiar form of the body.

This insect is very common towards the end of summer, and may often be seen resting on palings, etc., or on the herbage by the roadside; the brilliant red spot at the apex of the scutellum rendering it a very striking object. The general colour is brown, prettily mottled with black, while the beak, the antennæ, and the legs are of a bright red.

In common with many members of the group the *Tropicoris* possesses a powerful and singularly unpleasant smell, which, if the insect be handled, will cling to the fingers for a considerable time, in spite of repeated lavations. This disagreeable odour is also transmitted to the substances over which the insect walks, fruit of various kinds being often tainted to such a degree as to be rendered perfectly uneatable.

It is, however, under the control of the insect, which can exude or retain it at will. It is due to a fluid which passes from two small pores in the hinder tarsi, so that if the insect be carefully seized by the sides of the body, in such a manner that the feet cannot come into contact with the skin, it can be handled with perfect impunity.

The odour still clings to the insect for many months after death, and often renders the drawer in which the specimens are contained most terribly offensive to the olfactory organs.

The common bed bug *(Acanthia lectularia)* is also a member of this group. This is one of the apterous species of *Heteroptera*, the wings being only represented by two very small projections in the place of those organs.

This only too familiar insect is not an indigenous inhabitant of England, but is supposed to have been introduced into this country in the course of the last two or three hundred years; from whence, however, we cannot ascertain with any degree of certainty. Once imported, it spread with marvellous rapidity, rivalling the cockroach itself in the speedy manner in which it made its way even to the most remote parts of the country.

When once it has taken up its quarters in a room, the bed bug is a most difficult creature to disestablish, its small size and flat body enabling it to creep into the smallest crevices. Within these chinks are deposited the eggs, some fifty or sixty in number, which are always covered with a kind of varnish which hardens upon exposure to the atmosphere, and so fixes them securely to the substance upon which they are laid.

The most successful method of destroying these disagreeable insects appears to consist in burning large quantities of sulphur in the room in which they have taken up their residence, having previously stopped up every aperture through which the fatal vapour can possibly escape. After a few weeks the process must be repeated, in order to destroy those specimens which have emerged from the egg subsequently to the former campaign.

Passing over a large number of insects, which are of little interest except to those making a special study of the order, we come to the curious group which pass their existence upon the surface of the water, over which they can glide with considerable speed. These

are known in science as *Hydrometridæ*, or 'water-measurers,' and are so called because they seem to measure the surface of the water with their wonderfully long and slender limbs. Popularly they are known as Water-gnats, bearing, as they do, some little resemblance to a gnat from which the wings have been removed. They are to be seen in great numbers in almost every pond, passing along over the surface of the water with astonishing speed.

The fore-limbs do not appear to be employed for purposes of locomotion, but are stretched out in front of the body for the purpose of seizing prey. The hinder legs seem to act chiefly in directing the course, while upon the middle pair falls the task of propulsion.

In many specimens of water-gnats the wings are not developed, but remain in a rudimentary condition throughout the insect's existence. In others, however, they attain their full dimensions, and are quite capable of bearing their owner through the air. Upon alighting after an aerial excursion, the long hind limbs are employed in tucking the wings beneath the elytra.

Water-gnat (*Gerris lacustris*).

Included in the *Gymnocerata*, although not in Mr. Westwood's group of the *Aurocorisa*, are two very curious and interesting insects, each of which will be described in turn.

The first of these is the extraordinary creature known as *Ranatra linearis*, which would by very few people be recognised as an insect at all. In general appearance it is not unlike a gigantic water-gnat, from which insect, however, it differs in the two long bristle-like appendages springing from the end of the body. Its total length, measured from the extremity of the fore-legs, when fully stretched out, to the end of the bristle-like appendages at the tail, is rather more than three and a half inches, while the extreme width of the body is nowhere greater than one-seventh of an inch. The dull brown colour, slender body, and long limbs render the insect very far from conspicuous amongst the weeds of its native pond, and, until it moves, the creature can hardly be distinguished from the stems of the plants amongst which it is resting.

The *ranatra*, unlike the water-gnats, spends the greater part of its existence beneath the surface of the water, progressing by means of the two hinder pairs of legs. The fore-limbs seem to be used for the purpose of seizing prey alone, and are formed more like jaws than legs; so much so, indeed, that they would certainly be mistaken for those organs by any but an experienced observer.

The eggs of the *ranatra* are deposited in a very singular manner, which has been described by a correspondent of 'Science Gossip,' for November, 1879. He says: 'On July 7, I was much surprised to find the leaf of frog-bit exhibiting a most unusual appearance; the best verbal description that I can give of this appearance is, that the floating leaf appeared on the top to possess the antennæ of some moth, to which underneath was attached a small substance, something in shape like a canary seed, but more rounded at the extremities, especially at the end from which these antennæ or appanages spring. The leaf had evidently been pierced, and the appanages thrust through, which, opening into a V-like shape, kept the underneath substance from falling.

'I was much puzzled by these appearances, and being quite ignorant of what they were, called in one or two friends to see them, in the hope of acquiring information; but being unable to get any I then more anxiously watched, and almost came to the conclusion that they were the germs of some botanical production.

'The leaf of the frog-bit decaying they gradually sank, the same V-like appanage which had kept them in their position now keeping them from falling too fast or from sinking in the soft mud at the bottom of the aquarium; here they remained in a perpendicular position, and were watched from time to time. On August 4th I was delighted to find four young *ranatra* swimming freely about. They were about half an inch in length, and in form so like their parents that it was impossible to be deceived.

'The appearance of these young *ranatra* led to the discovery that the objects on the leaf of the frog-bit which had so puzzled me were the ova of this insect, for I found them all on the bottom of the aquarium quite empty, with an opening in the end between the antennæ or appanages.

'I cannot help thinking what an interesting sight it must have been to have watched the insect depositing the ova, how the leaf must have been pierced, the ova extended, the antennæ—if they may be so called—being thrust through the perforated opening, on which they must immediately have sprung into a wedge-like shape—opening wide at the top—to keep the ova in position.'

The *ranatra* is not a very common insect, but may be found in ponds and ditches in many parts of the country.

Belonging to the same family as the *ranatra* is a very different-looking insect, namely, the common Water-scorpion (*Nepa cinerea*). A very good idea of the general appearance of this insect may be obtained by a reference to the accompanying illustration, in which the flat, leaf-like body, the jaw-like fore-legs, and the appendages at the end of the body are very well depicted. The fore-limbs closely resemble those of the *ranatra*, and are used for a like purpose, namely, that of securing prey.

Water-scorpion (*Nepa cinerea*).

Were it not for the powerful likeness which it bears to the dead leaves and other *débris* found at the bottom of every pond the water-scorpion would find great difficulty in obtaining food, for its motions are far more sluggish than those of the water-insects, etc., upon which it preys. But, aided by its resemblance to surrounding objects, the insect waits patiently until some luckless victim comes within reach, when it is at once seized by the outspread fore-legs, conveyed to the

mouth, and its juices strained by means of the sharp proboscis.

The filaments at the end of the tail serve to convey air to the spiracles, which are placed at the end of the body, when the insect is beneath the water, the extremities of those appendages just appearing above the surface while their owner is altogether submerged. Those of the *ranatra* answer the same purpose.

The eggs of the water-scorpion are of a very singular form, being furnished with seven horn-like projections, arranged in a circle, by means of which they are fastened to the leaves of various water-plants, just as is the case with those of the preceding insect.

Although the water-scorpion almost invariably seeks its prey beneath the water, I know of one case, which came under my personal observation, in which there was an exception to this rule.

While standing, one warm summer's day, upon the banks of a small pond, which had been partly dried by the heat of the weather, I noticed a fly struggling in the mud which surrounded the edge of the water, and apparently in the grasp of some invisible adversary. Upon investigating the matter, I found that a water-scorpion had buried itself in the mud, with the jaws just projecting above the surface, and had seized the fly as it passed along unconscious of the presence of its enemy. The whole proceeding, in fact, bore a considerable resemblance to the mode of capture of prey followed by the ant-lion.

Although a very dull and sombre-looking insect when creeping slowly amongst the *débris* of the pond, the water-scorpion is really quite a handsome creature when the wings are spread in flight. The basal portion of the lower pair, as well as the greater part of the upper surface of the abdomen, are then seen to be of a brilliant red colour, which really renders the insect a striking object.

The water-scorpion is a very plentiful insect, and may be taken in numbers from any weedy pond.

Now we come to the second of the two great groups of *Heteroptera*, namely, the *Cryptocerata*, or those in which the antennæ are concealed from view. The most interesting of these, perhaps, is the common Water-boatman (*Notonecta glauca*), which we will accordingly take as a type of the group.

In the accompanying woodcut the position generally assumed by the boatman when swimming, or resting upon the surface of the water is very well repre-

Water-boatman *(Notonecta glauca).*

sented. In this curiously reversed position the insect passes the greater part of its existence in the water, and may be seen in numbers in almost any pond, resting motionless upon the surface of the water, unless disturbed by the shadow of a passer-by. Sometimes, however, on a fine and sunny morning, the boatman will turn over, and assume a rather remarkable attitude, resting upon the surface of the water with the elytra opened and the wings partially protruding.

The name of 'boatman' is wonderfully appropriate, the insect, in its reversed position, bearing a most striking resemblance to a boat with two long oars projecting from it. And the long hind limbs really take the place and fulfil the functions of oars, being fringed with long hairs, just as is the case with those of the *Dyticus* and other aquatic beetles, in order that they may offer a greater resistance to the water. The term '*Notonecta*' is also appropriate, that word signifying a 'back-swimmer,' and referring to the attitude assumed by the insect when in the water.

The 'feathering' principle, if we may so call it, of the swimming legs, is also quite as strongly marked as in the water-beetles, the limb mechanically turning sideways for the reverse stroke, and so presenting the edge only to the water, through which it cleaves without difficulty.

The respiratory system, too, is of much the same order, the space between the wings and the abdomen forming a kind of reservoir for the reception of air. Thus provided, the insect can spend a considerable time beneath the water without requiring to seek the surface in order to procure a fresh supply.

The wings of the *notonecta* are large and powerful, and are well adapted to bear their owner through the air. The insect is able to take to flight from the surface of the water, which it does as follows: First, diving to some little distance, it reverses its position so as to bring its head upwards; then, swimming rapidly towards the surface, it gives a smart stroke with the hinder legs, and so projects itself a few inches into the air. The wings are then immediately spread, and the insect flies off before it has time to fall back into the water.

(Some years ago, I had a number of water-boatmen in an aquarium. Seeing, to my great surprise, that they took to wing from the surface of the water, I leaned over the aquarium and looked into it. Presently, one of the insects dived, as has just been mentioned, sprang into the air, struck me on the nose, and fell back into the water. I wonder which was the more surprised, the insect or myself.—J. G. WOOD.)

The water-boatman is a very predacious creature, and seems to possess a particular fondness for the water-gnats, which it captures without difficulty as they are resting upon the surface of the water. In a very few moments the body is drained of its juices, and the boatman casts it aside and looks out for another victim.

The proboscis of the water-boatman is very sharp and strong, and is capable of inflicting a rather painful wound upon the fingers if the insect be not properly held. The saliva appears to possess a decidedly poisonous quality, as the wounded finger will swell and ache for hours in a manner which could scarcely be caused by the puncture alone.

Both the larva and pupa of the water-boatman bear a very strong resemblance to the perfect insect, from which, however, they can easily be distinguished by the absence of wings. In the former stage of development these organs are altogether wanting, while in the pupa they are quite rudimentary in size.

Closely allied to the water-boatman are a number of insects included under the generic title of *Corixa*, many of which are exceedingly plentiful in every pond. In habits and general appearance these little creatures closely resemble the preceding insect, from which they may be distinguished by several points of structure, such as the form of the body, which is flat instead of convex, etc.

(To be continued.)

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ANSWERS TO

Pupil Teachers' Examination Paper.

JUNE 24TH, 1882.

CANDIDATES.

Three hours and a half allowed.

Arithmetic.

MALES.

1. If there was a coin worth 2s. 10½d, what would be the worth of 276 of them?

	£	s.	d.
Value of 276 at £1 each =	276	0	0
" " 2s. 6d. = ¼ val. at £1 =	34	10	0
" " 0s. 3d. = 1/10 " 2s. 6d. =	3	9	0
" " 0s. 1½d. = ½ " 3d. =	1	14	6
" " ½d. = ½ " 1½d. =		5	9
Total value =	39	19	3 Ans.

2. If out of a yearly income of 900 guineas a man gives one-twelfth in charity, and spends on an average £11 5s. per week, what can he save in a year?

			£	s.
1/12 of 900 guineas	=	1/12 of £945 =	78	15
£11¼ × 52	=	£572 + £13 =	585	0
		Total expenditure =	663	15

£945 − £663 15s. = £281 5s. Ans.

3. Find the cost of 2,834 articles at 17s. 10½d. each, and show two ways of working it.

1st method—

	£	s.	d.
Value of 2,834 at £1 each =	2834	0	0
" " 10s. " = ½ val. at £1 =	1417	0	0
" " 5s. " = ¼ " 10s. =	708	10	0
" " 2s. 6d. " = ⅛ " 5s. =	354	5	0
" " 3d. " = 1/10 " 2s. 6d. =	35	8	6
" " 1½d. " = ½ " 3d. =	17	14	3
Total value =	2532	17	9 Ans.

2nd method—

	£	s.	d.
Value of 2,834 at £1 each =	2834	0	0
" " 2s. " = 1/10 val. at £1 =	283	8	0
" " 1½d. " = 1/10 " 2s. =	17	14	3
deduct total val. at 2s. 1½d. from val. at £ =	301	2	3
and the remainder =	2532	17	9 Ans.

4. How many yards of lace can be bought for £228 12s. 7d. at the rate of £1 15s. for 4½ yards?

£1 15s. : £228 12s. 7d. :: 4½ yds. : ?

or 420d. : or 54,871d. :: 4½ yds. : ?

$\frac{9}{2}$ yds. × $\frac{54871}{420}$ = $\frac{493839}{840}$ yds. = $555\frac{407}{840}$ yds. Ans.

FEMALES.

1. Make out the following bill:—

81 lbs. of tea at 2s. 11d. per lb.
99 lbs. of coffee at 1s. 7½d. per lb.
27 lbs. of cocoa at 1s. 5d. per lb.
243 lbs. of rice at 2¾d. per lb.
6 lbs. 8 oz. tea at 3s. 4d. per lb.
18 lbs. of sugar at 4¾d. per lb.
1 quarter lb. of cocoa at 1s. 4d. per lb.
21 lbs. of coffee at 1s. 8d. per lb.
3 doz. matchboxes at 1½d. each.

		s.	d.	£	s.	d.
81	lbs. at	2	11 per lb. =	11	16	3
99	" "	1	7½ " =	8	0	11½
27	" "	1	5 " =	1	18	3
243	" "	0	2¾ " =	2	15	8¼
6½	" "	3	4 " =	1	1	8
18	" "	0	4¾ " =	0	7	1½
¼	" "	1	4 " =	0	0	4
21	" "	1	8 " =	1	15	0
36	boxes "	0	1½ each =	0	4	6
			Total =	27	19	8¼ Ans.

2. Find the value of 13,789 articles at £81 4s. 1½d. each.

	£	s.	d.
Value of 13,789 at £1 each =	13,789	0	0
	81		
" " £81 =	1,116,909	0	0
" " 3s. 4d. = ⅙ val. at £ =	2,298	3	4
" " 8d. = ½ " 3s. 4d. =	459	12	8
" " 1d. = ⅛ " 8d. =	57	9	1
" " ¼d. = ¼ " 1d. =	14	7	3½
Total value =	1,110,728	12	4½

3. What is the cost of 118 c. yds. 10 c. ft. 216 c. in. at £1 4s. 10d. per c. yd.?

		£	s.	d.
Cost of 1 c. yd.	=	1	4	10
				118
,, 118 ,,	=	146	10	4
,, 9 c. ft. = $\frac{1}{12}$ cost of 1 c. yd.	=		8	$3\frac{1}{2}$
,, $1\frac{8}{12}$,, = $\frac{1}{12}$,, 9 ,,	=		1	$0\frac{6}{12}$
Total value	=	146	19	$7\frac{3}{4}$ Ans.

4. How many pencil-cases, each weighing 10 dwt. 6 grs., could be made out of 7 oz. 3 dwt. 12 grs. of gold?

10 dwt. 6 grs. = 246 grs.
7 oz. 3 dwt. 12 grs. = 3444 grs.
3444 ÷ 246 = 14 pencil-cases. Ans.

Grammar.

1. 'Come, sister, put your tasks away,
And don with speed your woodland dress,
And bring no book; for this one day
We'll give to idleness.'

Parse the verbs and adjectives in the above.

VERBS.

Come—intrans. irreg., *come, came, come*, imper., 2nd pers., sing., agr. with (*thou*).
put—trans. irreg. *put, put, put*, imper., 2nd pers. sing., agr. with (*thou*).
don—trans. reg. imper., 2nd pers. sing., agr. with (*thou*).
bring—trans. irreg. *bring, brought, brought*, imper., 2nd pers. sing., agr. with (*thou*).
will—irreg. defec. *will, would*, indic., pres., 1st pers. plur., agr. with *we*.
give—trans. verb. irreg. *give, gave, given*, infin. pres. gov. by *will*.

ADJECTIVES.

(1) *your*— pronom. poss. limiting *tasks* and (2) *dress*.
woodland—distinguishing ,, ,, *dress*.
this— ,, ,, ,, *day*.
one—numeral ,, ,, ,, *day*.
no—negative ,, ,, ,, *book*.

2. What is a noun of multitude? Give examples to show what should be the number of the verb agreeing with such nouns.

A noun of multitude, or collective noun, is one that in the singular stands for one collection of several individual things, as *herd, multitude*. In the plural it stands for several such *collections*.

When the noun of multitude conveys an idea of unity, the verb must be singular, as, 'The army was routed.' But when an idea of plurality is conveyed, the verb must be plural, as, 'The French peasantry wear wooden shoes.'

3. Give examples of adjectives both before and after the nouns they qualify.

Before the noun.	After the noun.
He is a *loyal* subject.	He is a man *loyal* to his king.
That is a *deep* well.	The well is six feet *deep*.

With eyes *upraised*, as one *inspired*,
Pale Melancholy sat.

Geography.

Answer two questions.

1. Describe minutely the course of a ship sailing along the coast from Liverpool to Gloucester.

Starting from *Liverpool*, the greatest seaport in the British Empire, we sail from the Mersey south past the mouth of the Dee, on which stands *Chester*, with its old walls and covered walks, past *Holywell*, and round Great Orms Head. Continuing south-west, we come to *Conway*, *Bangor*, (Holyhead, the packet-station for Dublin, stands on the west side of Anglesea). We pass through the Menai Strait, which is spanned by two magnificent bridges, and enter Carnarvon Bay, on which stands *Caernarvon*, the largest town in North Wales. Doubling Bardsey Point, we enter the capacious *Cardigan Bay*, on which stand *Harlech*, *Barmouth*, *Aberystwith*, and *Cardigan*. Passing *Fishguard*, we round *Strumble Head*, *St. David's Head*, *Bride's Bay*, and enter Milford Haven, one of the finest harbours in Britain, on the shore of which is *Pembroke*. Beyond St. Gowen's Head, we pass Caermarthen Bay, and rounding Worms Head, we come to *Swansea*, with large copper-melting works, *Cardiff* at the mouth of the Taaf, the chief port for minerals in South Wales. Leaving Cardiff, we sail up the Severn past Newport, Chepstow, and Berkeley, reaching Gloucester, where the river meets the tide.

2. Describe as fully as you can, the situation and character of Penzance, Torquay, Scarborough, Whitby, Rothesay, and Oban.

Penzance stands on the N. W. side of Mount's Bay, and has an extensive pilchard fishery. It is remarkable for the salubrity and mildness of its air.

Torquay is beautifully situated on Tor Bay, is much frequented as a watering-place, and because of its mild climate as a winter residence for invalids.

Scarborough, a seaport town in the North Riding of Yorkshire, about thirty-six miles from York, is the most fashionable watering-place on the N. E. coast.

Whitby, a seaport about twenty miles from Scarborough, in the North Riding of Yorkshire, is a summer resort.

Rothesay, beautifully situated on the east side of the island of Bute in the F. of Clyde, is much resorted to for sea-bathing, and as a winter residence for invalids.

Oban is situated on the west coast of the north part of Argyleshire. The beautiful bay on which it stands is protected by the Island of Kerrera. It is the central point for steamboats trading among the Western Isles, and a great centre for tourists in the summer.

Composition.

Write from dictation the passage given out by the Inspector.

Penmanship.

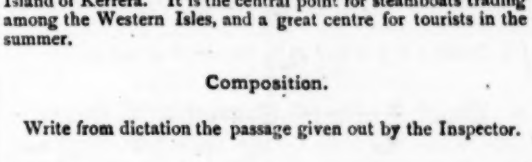
Write, in large hand, as a specimen of copy-setting, the word *Hospitality*.

Write, in small hand, as a specimen of copy-setting, *A special tribunal was installed in the citadel.*

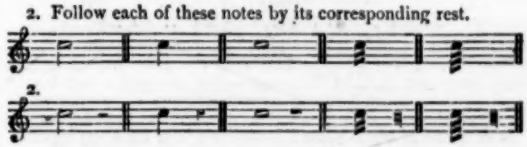
Music.

A quarter of an hour allowed for this paper.

1. Write over each of the following notes its pitch name (C, D, *Do, Re*, or other), and under each its duration name (crotchet, quaver, or other).



2. Follow each of these notes by its corresponding rest.



3. Supposing we make one beat while we sing a crotchet, how many shall we make while we sing four quavers?

3. If we make *one* beat while we sing a crotchet, we must make *two* while we sing four quavers, because one crotchet is equal to two quavers.

FIRST YEAR.

Pupil Teachers at end of First Year.

Three hours and a half allowed for this Paper.

Arithmetic.

MALES.

1. From a field of $12\frac{3}{4}$ acres are taken off three equal portions of $1\frac{7}{8}$ acres each, and also two portions of 2 roods 15 poles each, how much remains?

	ac.	ro.	po.
$1\frac{7}{8}$ ac. × 3	= 3	2	4
2 ro. 15 po. × 2 =	1	0	30
	4	2	34

	ac.	ro.	po.
The whole field =	12	2	16
Deduct	4	2	34
Remainder =	7	3	20. Ans.

2. Explain when and why it is necessary to bring fractions to a common denominator. Reduce $\frac{5}{6}$, $\frac{8}{11}$, and $\frac{7}{12}$ to a common denominator.

In adding or subtracting fractions, it is necessary to bring them to a common denominator, as we can only add or subtract quantities of the same kind or of the same denomination. It is necessary in simple addition or subtraction to place units below units, tens below tens, etc. So in fractions we can add or subtract fourths and fourths, sevenths and sevenths, etc., that is, fractions of the same denomination.

The L. M. C. of 9, 21, and 12 = 252.

Therefore $\frac{5}{6}$, $\frac{8}{11}$, and $\frac{7}{12}$ reduced to a common denominator = $\frac{210}{252}$, $\frac{176}{252}$, and $\frac{147}{252}$. Ans.

3. Divide $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of 42 by the sum of $2\frac{1}{2}$ and $4\frac{1}{5}$.

$$(\tfrac{1}{2} \text{ of } \tfrac{2}{3} \text{ of } \tfrac{3}{4} \text{ of } 42) \div (2\tfrac{1}{2} + 4\tfrac{1}{5}) =$$

$$\frac{1 \times 2 \times 5 \times 42}{2 \times 3 \times 7} \div 6\frac{34}{45} =$$

$$10 \times \frac{45}{304} = \frac{450}{304} = 1\frac{73}{152}. \text{ Ans.}$$

4. What is the sum of 264 hundredths, 18 tenths, 34 millionths, and 62,584 hundred-thousandths?

264 hundredths	= 2·64
18 tenths	= 1·8
34 millionths	= ·000034
62,584 hundred-thousandths	= ·62584
	5·065874

The sum is 5,065,874 millionths. Ans.

FEMALES.

1. If 9 men can mow a field whose length is 630 ft. and breadth 420 ft. in $1\frac{1}{2}$ days, working 12 hours a day; how many hours a day must 6 men work to mow another field 1,080 ft. long by 840 ft. broad in $7\frac{1}{2}$ days?

$$\left.\begin{array}{l} 6 \text{ men} : 9 \text{ men.} \\ 7\frac{1}{2} \text{ da.} : 1\frac{1}{2} \text{ da.} \\ 630 \text{ ft.} : 1080 \text{ ft.} \\ 420 \text{ ft.} : 840 \text{ ft.} \end{array}\right\} :: 12 \text{ ho.} : ?$$

$$\frac{12 \text{ ho.} \times 9 \times 3 \times 1080 \times 840}{6 \times 15 \times 630 \times 420} = 4\tfrac{2}{5} \text{ ho.} = 12\tfrac{1}{2} \text{ ho. Ans.}$$

2. A man owes £3,074 7s. 8d., but can only pay £1,921 9s. 2d.; how much shall I receive in the pound on a debt of £500?

£3074 7s. 8d. : £1921 9s. 2d. :: £1 : ?

or or

737,852d. : 461,150d.

$$\frac{£1 \times 461{,}150}{737{,}852} = 12\text{s } 5\tfrac{1}{4}\tfrac{1}{4}\tfrac{1}{4}\tfrac{1}{4}\text{d. Ans.}$$

3. A school of 260 children contains 3 boys for every 2 girls; how many scholars are there of each sex?

Ratio of boys to girls = 3 : 2, that is, out of every 5 scholars 3 are boys, and 2 girls.

∴ 5 : 260 :: 3 boys : 156 boys. Ans.

And 5 : 260 :: 2 girls : 104 girls. Ans.

4. 144 men make two miles of sewers 18 ft. deep in 300 days of 10 hours each; how many men would it require to make the same sewers 2 ft. deeper in the same number of days, but working 8 hours daily instead of 10?

$$\left.\begin{array}{l} 18 \text{ ft.} : 2 \text{ ft.} \\ 8 \text{ ho.} : 10 \text{ ho.} \end{array}\right\} :: 144 \text{ men} : ?$$

$$\frac{144 \text{ men} \times 2 \times 10}{18 \times 8} = 20 \text{ men. Ans.}$$

Grammar.

1. Point out and parse all the pronouns and adverbs in the following:—

'Violent fires soon burn out themselves;
Small showers last long, but sudden storms are short;
He tires betimes that spurs too fast betimes.'—SHAKSPERE.

PRONOUNS.

themselves—compound, personal, reflective, referring to 'fires,' 3rd pers., neut. plur., obj., gov. by *burn*.
he—simple pers., used indefinitely, 3rd pers. sing., mas., sing., nom. to *tires*.
that—simple rel. referring to 'he,' 3rd pers., sing., mas., nom. to *spurs*.

ADVERBS.

soon—	adv. of time,	mod. *burn*.
out—	,, degree,	mod. *burn*.
long—	,, time,	mod. *last*.
betimes—	,, ,,	,, *tires*.
too—	,, deg.	,, *fast*.
fast—	,, manner	,, *spurs*.
betimes—	,, time	,, *spurs*.

2. Decline the pronoun 'who,' and state what rule is to be observed in the use of 'who' and 'which.'

'Who' is declined thus: sing. and plur., Nom. *Who*, Poss. *Whose*, Obj. *Whom*.

'Who' is applied to persons only. 'Which' to infants, irrational animals, and things.

3. Write two sentences in which the preposition comes *after* the objective.

(1) Have you seen the man *that* I sent the letter *to*?
(2) This is the person *whom* you alluded to.

Geography.

1. Draw a map of the coast line from Cadiz to Naples. Insert the lines of latitude and longitude.

2. Describe fully the river system of Russia, and show how the courses of the rivers are determined by the nature of the country.

The rivers of Russia are divided into three groups, (1) those which flow into the Black Sea, and the Caspian, (2) those flowing into the Baltic; (3) those which flow into the Arctic Ocean. The rivers flowing into the Caspian are slow and sluggish, owing to the ground being very level. The Volga, the largest river in Europe, rises in the Valdai Hills, 550 feet above the level of the sea, and after a course of 900 miles, terminates in numerous marshy mouths on the N. W. side of the Caspian. It is navigable almost from its source to its mouth, but the navigation is often impeded, owing to sand-banks and the shifting of its channel.

The chief of the Black Sea rivers are the Don, the Dnieper, and the Dniester, which flow through higher lands, along deep channels rather than river valleys. The Baltic receives from Russia the Dvina, and the Neva, on which St. Petersburg stands.

The two largest flowing into the Arctic Ocean are the N. Dvina, and the Petchora.

The courses of rivers in every country are determined by the slope of the land called the 'water-shed' the highest point of which is the 'water-parting.' In Russia the chief water-parting is the highest ridge of the Valdai Hills, a round backed cluster commonly described as of a dome-like form. This group of hills may be compared to a knuckle of land, which turns the rivers in *three* directions, as has been shown above.

History.

1. What sovereigns were reigning in the years 900, 1000, 1100, and 1200?

Alfred the Great was reigning in 900.
Ethelred the Unready „ 1000.
William II. (Rufus) „ 1100.
Richard I. (Cœur-de-Lion) „ 1200.

2. Write out a list of sovereigns of the House of York, and the House of Stuart, with their dates.

HOUSE OF YORK.

	A.D.
Edward IV. began to reign	1461.
Edward V. „ „	1485.
Richard III. „ „	1485.

HOUSE OF STUART.

	A.D.
James I. began to reign	1603.
Charles I. „ „	1625.
(Commonwealth from 1649-1660.)	
Charles II. restored	1660.
James II. began to reign	1685. (dethroned 1688).
William III. and Mary II. „	1689.
Anne „ „	1702-1714.

3. Give the dates of all our kings named Henry, and tell the line to which each of them belongs.

	A.D.		A.D.	
Henry I. reigned from	1100	till	1135	(Anglo-Norman Line).
Henry II. „ „	1154	„	1189	(Plantagenet „)
Henry III. „ „	1216	„	1272	(„ „)
Henry IV. „ „	1399	„	1413	(Lancaster „)
Henry V. „ „	1413	„	1422	(„ „)
Henry VI. „ „	1422	„	1461	(„ „)
Henry VII. „ „	1485	„	1509	(Tudor „)
Henry VIII. „ „	1509	„	1547	(„ „)

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Hospitality*.

Write, in small hand, as a specimen of copy-setting, *A special tribunal was installed in the citadel.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Music.

A quarter of an hour allowed for this paper.

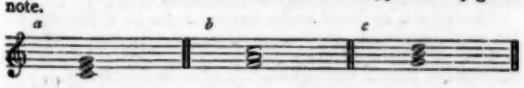
1. What is meant by *sound*, what by a *tone*; and how does a sound differ from a tone?

1. *Sound* is the effect on the ear of the vibration of the air caused by some disturbing force. When the vibration is regular, the result is a *musical* sound.

A *tone* is the interval between two sounds, either higher or lower, and can be divided into two semitones.

2. What is a *triad*? Write in *a*, *b*, and *c* severally the triads of (C) *Do*, (F) *Fa*, and (G) *Sol*.

2. A *triad* is the addition of its *third* and *fifth* to any given note.



3. How many tones and how many semitones are found in the diatonic major scale, and what are the places in it of the latter?

3. Five tones and two semitones, the latter being found between the third and fourth, and seventh and eighth notes.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. At what rate per cent. would £1,720 amount to £1,978 in five years?

Interest on £1,720 = £(1,978 − 1720) = £258.

$$\left.\begin{matrix}5\text{ yr.}:1\text{ yr.}\\ £1720:£100\end{matrix}\right\}::£258:?$$

$$\frac{£258\times 100}{5\times 1720}=3\text{ p. c.}\quad\text{Ans.}$$

2. What sum of money must be invested at 3¾ per cent. so as to secure an annual income of £250?

$$£3\tfrac{3}{4}:£250::£100:?$$

$$\frac{£100\times 250\times 4}{15}=£6{,}666\ 13\text{s. }4\text{d.}\quad\text{Ans.}$$

3. Find the interest on £1,813 19s. at 3½ per cent. for nine months.

£	s.	d.	
1813	19	0	
			3½
453	9	9	
5441	17	0	
5895	6	9	
			¾
4 | 17686	0	3	
44'21	10	0·75	
20			
4'30	s.		
12			
3·675			

Interest = £44 4s. 3¾d. Ans.

4. What is the difference between the annual income arising from the investment of £2150 in 3½ per cent. stock at 87½, and that from investing the same sum in the 3 per cents. at 86¼?

(*a*) Interest per £ in the 3½ $= \frac{3\frac{1}{2}}{87\frac{1}{2}} = \frac{26}{697} = \frac{4}{1075\frac{1}{2}}$

(*b*) „ „ 3 $= \frac{3}{86\frac{1}{4}} = \frac{6}{173} = \frac{4}{1076\frac{1}{2}}$

diff. of interest per £ invested $= \frac{1}{1076\frac{1}{2}}$

$\therefore £2150\times\frac{1}{1076\frac{1}{2}} = £\frac{2150}{1076\frac{1}{2}} = £5\ 12\text{s. }8\frac{800}{1076\frac{1}{2}}\text{d.}$ Ans.

FEMALES.

1. Simplify $\frac{901}{713}\div\frac{1219}{1343}\times\frac{2449}{5353}$

$$\frac{901\times 1219\times 2449}{713\times 1343\times 5353}=\frac{53}{101}\quad\text{Ans.}$$

2. Find the value of $6\frac{7}{10}$ days $-\frac{5}{14}$ week $-\frac{1}{12}$ min. $+\frac{2}{3}$ hr.

		da.	ho.	min.	sec.
$6\frac{7}{10}$ days	=	6	16	48	0
$-\frac{5}{14}$ wk.	=	4	12	0	0
diff.	=	2	4	48	0
$-\frac{1}{12}$ min.	=				44
diff.	=	2	4	47	16
$+\frac{2}{3}$ ho.	=			36	0
sum.	=	2	5	23	16 Ans.

3. The rateable value of a person's property is fixed at ⅘ of its gross value, which is 2,000 guineas. What will be his net income after paying two poor rates of 8¾d., and 1s. 1d. in the pound respectively, a highway rate of 4½d. in the pound, and an income tax of 2½ per cent. on his gross income?

(*a*) ⅘ of 2000 guin. = £1260 the rateable value.
(*b*) Rate per £ = 8¾d. + 1s. 1d. + 4½d. = 2s. 2d.
(*c*) £1,260 at 2s. 2d. = £136 10s. 0d.
(*d*) Income tax = $\frac{£2100\times 45}{16\times 100}$ = 59 1 3
Total to pay 195 11 3
(*e*) £2,100 − £195 11s. 3d. = £1904 8s. 9d. net income.

4. ⅓ of a draper's stock was destroyed by fire, ⅓ of the remainder was injured by water; he sold the uninjured goods at cost price, and the injured goods at ⅓ cost price, and realized £225. What did he lose by the fire?

Remaining stock injured by water = ⅓ of ⅔ = $\frac{2}{9}$
" uninjured " = ⅔ − $\frac{2}{9}$ = $\frac{4}{9}$
Selling $\frac{2}{9}$ for half cost price = selling $\frac{1}{9}$ at cost price.
∴ $\frac{4}{9}$ + $\frac{1}{9}$ or $\frac{5}{9}$ is sold for £225.
Then $\frac{5}{9}$: $\frac{9}{9}$ :: £225 : sum lost by fire.

$$\frac{£225 \times 7^{1}}{9} = £1775.$$ Ans.

Grammar.

1. 'I made them *lay* their hands in *mine*, and swear
To reverence the king as if he *were*
Their conscience, and their *conscience* as their king;
To ride abroad *redressing* human wrongs,
To honour *their own word* as if their God's.'

(*a*) Analyse the first three lines of the above.
(*b*) Parse the words in italics.
(*c*) Point out the conjunctions, and show what is the use of each in the above passage.

(*a*)

Sentence.	Kind of Sent.	Subject.	Predicate.	Object and Completion.	Connective.
(1) I made them lay their hands in mine and swear to reverence the king and their conscience	Principal	I	made	(1) them (direct) (2) lay their hands in mine (indirect) (3) and swear to reverence the king (indirect) (4) (to reverence) their conscience (indirect)	—
(2) as if he were their conscience.	Subordinate adv. to (1) (manner)	he	were (incomplet.)	their conscience (completion of Predicate)	as if
(3) as (*if it were*) their king	Subordinate adv. to (1) (manner)	(*it*)	(*were*) (incomplete)	their king (completion of Predicate.)	as (if)

(*b*) *Lay*—irreg. trans. verb, *lay, laid, laid*, infin., pres., indef., gov. by *made*, after which "to" is suppressed.
mine—simple pers. prcn., referring to *I*, 1st pers. com., sing., poss., attrib. to *hands*.
were—irreg. subst. verb, *am, was, been*, subjunctive, past indef., 3rd pers. sing., agr. with *he*.
their—pronom. poss. adj., limiting *conscience*.
conscience—abstr. noun, neut. sing., nom., after *were*.
conscience— " " " " obj., gov. by (*reverence*).
redressing—reg. trans. verb, part. pres. attrib. to *them*.
their / *own* —pron. poss. adj., limiting *word*.
word—abstr. noun, neut. sing. obj., governed by *honour*.

(*c*) (1) *and*—co-ord. conj., connecting two clauses of equal importance, viz., '*swear to reverence the king*,' with '*lay their hands in mine*.'
(2) *as if*—subord. conjunc., connecting the subord. clause, '*he were their conscience*,' with the principal sent. '*I made . . . the king*.'
(3) *and*—co-ord. conj., connecting '(*to reverence*) *their conscience*' with '*to reverence the king*.'
(4) *as* (*if*)—subord. conj., connecting '(*it were*) *their king*' with '*I made them* (etc.), *and swear to reverence their conscience*.'
(5) *as if*—subord. conj., connecting '(*it were*) *their God's* (*word*),' with '*I made them* (etc.) *swear to honour their own word*.'

2. Some conjunctions are derived from nouns, some from adjectives. Give examples of both kinds, showing what noun or adjective each is derived from.

Both is only the adjective *both* used with relation to two sentences joined by *and*.
Either is the distributive adjective pronoun which stands for *other*, used with relation to a whole sentence.
That was originally the demonstrative adjective pronoun, used as the representative of a sentence.
Because is merely the compound phrase *by cause*.
Unless is a compound of *on* and the comparative *less*.
While is derived from *the while* = *the time*.

Geography.

Answer Q. 2 *or* Q. 3; *not both*.

1. Give full notes of a lesson on 'The St. Lawrence and the chain of lakes connected with it.'

N.B.—*No introduction*. Make your lesson full and descriptive.

'The St. Lawrence and the Great Lakes.'

Apparatus—Map of North America, or a Sketch on the Black Board.

The St. Lawrence receives different names in different parts of its course. Rises under the name of *St. Louis*, a little to the west of L. Superior, and near the sources of the Red River and the Mississippi. (*Show these rivers.*) Between L. Superior and L. Huron the river is called *the St. Mary*; between Huron and Erie *the St. Clair*, and *Detroit*; and between Erie and Ontario *the Niagara* (Falls of Niagara occur here, precipitated over rocks 150 feet high—*description given*). After leaving Ontario the river is called the St. Lawrence, which flows in a north-easterly direction into the Gulf of St. Lawrence. In this part of its course it receives the *Ottawa*, *Richelieu*, *St. Francis*, *St. Maurice*, and *Saguenay*. The total length of the river is 2000 miles.

Lake Superior is the greatest body of fresh water on the globe—420 miles long and 160 broad, and lies 630 ft. above the level of the sea. It receives 200 rivers and streams, and discharges its water into L. Huron.

Lake Huron, 200 miles long, 160 broad, communicates with L. Superior and L. Michigan on the west, and by St. Clair and the Detroit with L. Erie on the east. Along its northern shore is a chain of richly-wooded islands, called the *Manitoulin* or *Sacred Isles*.

Lake Michigan lies in the United States, is 360 miles long, with an average breadth of 60 miles, and is navigable for ships of any burden. It communicates with the north-west extremity of L. Huron.

Lake Erie is 250 miles long, and its greatest breadth 80 miles. It discharges its waters into Lake Ontario by the Niagara. It is subject to violent storms, which, with rocks projecting many miles from the shore, render the navigation extremely dangerous. The Erie Canal borders its shore, and avoids the Falls of Niagara, and the Ohio Canal connects it with the Ohio and the Mississippi.

Lake Ontario, the most easterly of the great American lakes, is 180 miles long and 65 broad, and of great depth. It receives the waters of Lake Erie by the Niagara, and discharges them by the St. Lawrence. Steam vessels constantly ply between the British and American sides. The country along its shores is rich and well wooded.

2. Draw little sketch maps to show the position, etc., of Ceylon, Hong Kong, the Mauritius, Antigua, Vancouver's Island; and say briefly what you know about each of them.

Ceylon is an island in the Indian Ocean separated from India by the Gulf of Manaar and Palk Strait. The interior of the southern part is mountainous, *Adam's Peak* being the highest point westward. There is only one river of any importance, the *Mahavelli Canga*. The soil is rich and the vegetation luxuriant. Plantations of cinnamon border the coast on the S. W. for a hundred miles. The elephants of Ceylon are famed for their size and sagacity. The chief towns are *Colombo* and *Kandy*. The two principal ports are *Point de Galle* and *Trincomalee*.

Hong Kong is a small island at the mouth of the Canton river, ceded by the Chinese to Britain in 1842. The population is about 140,000, and the capital is Victoria.

Mauritius is an island in the Indian Ocean E. of Madagascar. Its most important production is sugar. It was named in honour of Prince Maurice of the Netherlands; and it has belonged to Britain since 1810. Bourbon is the capital.

Antigua is one of the Leeward group of the British West India Islands. The chief products exported are sugar, molasses, and rum. The capital is *St. John*.

Vancouver's Island forms part of the province of British Columbia, and lies off the west coast of British N. America. Its surface is well wooded and diversified by mountain ranges and

extensive prairies. Coal is abundant, and Victoria the capital is an important coaling-station.

3. Draw a map of the coast-line from Cadiz to Naples, and insert the lines of latitude and longitude.

SECOND PAPER.

Two hours and a half allowed.

History.

1. Describe the reign of Edward the Confessor, and explain the kingdom's loss of strength at that period.

Edward the Confessor had been brought up at the Norman court, and this was the occasion of great trouble to him. The great Earl Godwin having gained complete supremacy over the king, married him to his own daughter, and established himself and his sons in the chief earldoms of the country. In Edward's court were some Norman nobles, who seemed to divide the king's heart with Godwin and his sons; these therefore sought to make it a national quarrel; but some of the earl's Saxon enemies sided with the Normans, and thus began that discord which weakened the Saxon influence. Civil war arose through a riot at Dover, but a truce was made without bloodshed, and Godwin and his sons were banished. William of Normandy having come over to England, the Norman influence grew stronger after his visit. A change came, and Godwin and his sons were re-instated, and shortly after the earl died, leaving his possessions to his son Harold, who continued to weaken the strength of the kingdom by civil wars and ceaseless broils. He is even said to have slain Edward's nephew and heir with his own hand. Upon this (1066) the old King gave the succession to his cousin William of Normandy. Edward abolished the Dane-gelt, and introduced Norman law-customs into English courts, which have never left them. The laws of the Confessor were regarded by the Saxons as the bulwark of the little liberty that remained to them under the sway of the Normans.

2. Tell the names of the mother and the wife of Stephen. Under what arrangement did his successor take the throne?

Stephen was the son of Adela, daughter of William I., and his wife was Matilda, daughter of the Count of Boulogne and niece of David of Scotland. His successor was Henry Plantagenet. By the treaty of Winchester Stephen was allowed to keep possession of the throne during his life, and Henry was to be his successor.

3. Between William I. and Henry VII. which of our kings met with a violent death? Briefly narrate the circumstances of each case, with dates.

While *William II.* was hunting in the New Forest, he was shot either intentionally or accidentally by an arrow from the bow of Sir Richard Tyrrel (1100).

Edward II. was put to death in a fearful manner in Berkeley Castle (1327).

Richard II. is supposed to have been murdered by assassins in Pomfret Castle (1399).

Henry VI is believed to have been murdered in the Tower (1471).

Edward V. was murdered in the Tower by order of his uncle Richard III. (1483).

Richard III. was slain at the Battle of Bosworth (1485).

Composition.

Write full notes of a lesson on *A Farm.*

INTRODUCTION.—We are going to take a walk into the country to a *farm.* What road shall we take? We may go through fields. At which season would the children prefer to go? (*description of road to the farm house*).

THE FARM-HOUSE.—Dwelling-house by itself—garden behind—with what vegetables?—orchard perhaps, kinds of *fruit-trees* in it—beehives perhaps, ask about bees.

OUTHOUSES.—The barn, granary, stable, cow-house, pig-sty, poultry-house, questions to draw out information respecting these houses and their uses. The barn may have a mill-wheel outside for turning machinery inside to thresh the corn, the winnowing machine to clean the grain before it is stored in the granary; in the stable may be horses, or they may be out ploughing, or taking grain to the mill to be ground into meal, etc.: in the cow-house may be cows to be milked (when?), or it may be clean and ready for them when they come from the fields in the evening. (*In the same way question the children about the other outhouses.*

ANIMALS.—The *horses* may be in the stables, or out in the fields, according to the season, drawing the plough, pulling the harrows, or the roller, the reaping machine, or pulling waggon-loads of hay, corn, etc., home to the farm; the *cattle* may be out feeding on the grass; the cows may be coming home to get milked; some may be in the stall fattening for the market; the *sheep* in the fields nibbling the grass in summer, or feeding on turnips during winter and early spring (*why?*); the poultry running about the farm-yard picking up grain, or the farmer's wife may be feeding them by scattering corn; dogs for watching house and herding sheep. (*Draw from them information about feeding the various animals.*)

IMPLEMENTS.—Ploughs, harrows, rakes, rollers, sickles, hoes, carts, waggons, reaping machines, etc.

FIELDS—for wheat, barley, oats, potatoes, turnips, pasture, hay, etc.

Pictures of the various objects to be shown if necessary.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Hospitality.*

Write, in small hand, as a specimen of copy-setting, *A special tribunal was installed in the citadel.*

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used]

1. The angles which one straight line makes with another upon one side of it are either two right angles, or are together equal to two right angles.

Prop. 13, Bk. I.

2. The greater angle of every triangle is subtended by the greater side, or has the greater side opposite to it.

Prop. 19, Bk. I.

3. If from the ends of a side of a triangle there be drawn two straight lines to a point within the triangle; these shall be less than the other two sides of the triangle, but shall contain a greater angle.

Prop. 21, Bk. I.

Needlework.

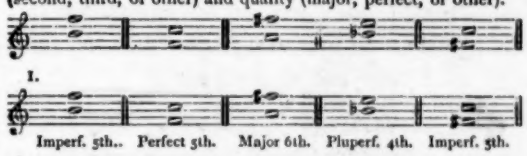
FEMALES.

One hour allowed for this exercise.

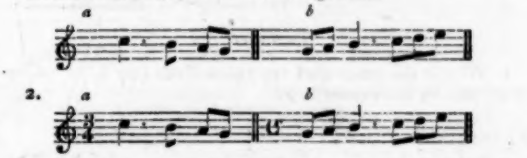
Music.

A quarter of an hour allowed for this Paper.

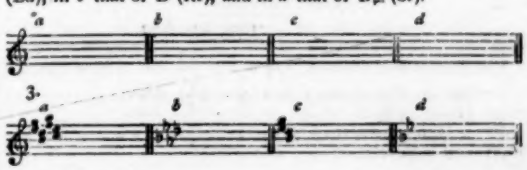
1. Write under each of the following intervals its name (second, third, or other) and quality (major, perfect, or other).



2. Place before *a* and *b* their time signatures.



3. Write in *a* the scale signature of E (*Mi*), in *b* that of A♭ (*La*), in *c* that of D (*Re*), and in *d* that of B♭ (*Se*).



THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after,* 1st *May,* 1878; **and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. Air is composed of three gases, 75·55 per cent. being nitrogen, 23·32 oxygen, and 1·13 carbonic acid. In a chamber containing 3,274 cubic feet, how much is there of each gas?

Nitrogen = $\frac{75·55}{100}$ of 3,274 c. ft. = 2473·507 cub. ft. Ans.

Oxygen = $\frac{23·32}{100}$ „ = 763·4968 „ Ans.

Carbonic acid = $\frac{1·13}{100}$ „ = 36·9962 „ Ans.

2. If 1 cwt. 3 qrs. 4 lbs. are purchased for £50, what should be the retail price per lb. to give a profit of 5 per cent.?

1 cwt. 3 qrs. 4 lbs. = 200 lbs.
∴ £50 ÷ 200 = 5s. the price of a lb.
100 : 105 :: 5s. : retail price.
$\frac{5s. \times 105}{100}$ = 5s. 3d. Ans.

3. How many planks, each 13½ feet long and 10½ inches wide, will be required for the construction of a platform 54 yds. long and 21 yds. broad? What will be the cost at 5½d. per sq. foot?

(*a*) Area of platform = 54 yds. × 21 yds. = (1134) sq. yds.
„ „ planks = 13½ ft. × 10½ in. = (162 × 10½) sq. in.
∴ The No. of planks = $\frac{1134 \times 9 \times 144 \times 2}{162 \times 21}$ = 864 Ans.

(*b*) 1134 sq. yds. at 5½d. per sq. ft. =
10206 sq. ft. at 5½d. each = £233 17s. 9d. Ans.

4. Explain the difference between simple and compound interest, and compare the interest of £119 for 3 years at 4 p. c. on the two methods.

Simple interest is when the interest is always kept distinct from the principal. Compound interest is when the interest is added at certain periods to the principal, and interest allowed on the increased amount.

(*a*) Simple interest on £119 for three years at 4 p. c. =
£$\frac{119 \times 3 \times 4}{100}$ = £14·28 = £14 5s. 7·2d.

(*b*) Compound interest—

4 p. c. gives 1/25 of principal to be added every year.	£	
	119	
	4·76	
	123·76	Amt. for 1st year
	4·9504	
	128·7104	„ „ 2nd „
	5·148416	
	133·858816	„ „ 3rd „
	119	
	14·858816	Comp. int. at end of 3rd yr.
		= £14 17s. 2·1d.

FEMALES.

1. What is the quotient of 129·75896 divided by 8, by ·08, by ·0008, and by 800 respectively?

(*a*) 8 | 129·75896 — 16·21987 Ans.

(*b*) ·08 | 129·75896 — 1621·987 Ans.

(*c*) ·0008 | 129·75896 — 162198·7 Ans.

(*d*) 800 | 129·75896 — ·1621987 Ans.

2. Compare the values of ·875 of 10s. 6d. and ·785 of 13s. 4d.

(*a*) ·875 of 10s. 6d. = 9s. 2¼d. Ans.
(*b*) ·785 of 13s. 4d. = 10s. 5⅞l. Ans.
(*b*) is greater than (*a*) by 1s. 3⅞d.

3. Find the values of (*a*) ·890625 bus.
(*b*) £2·3375.
And explain the method in each case.

(*a*)

	·890625 bus.
Multiply by 4 to reduce to pks.	4
Cut off 6 decimals	3·562500 pks.
Multiply fractional part by 2 to reduce to galls.	2
Point off 6 decimals	1·125000 gall.
Multiply the fractional part by 8 to reduce to pts.	8
Point off 6 decimals	1·000000 pt.

3 pecks. 1 gall. 1 pt. Ans.

(*b*)

	£2·3375
(1) Multiply the fractional part by 20	20
and point off 4 decimals to get	6·7500s.
(2) Multiply the fractional part by 12	12
and point off 4 decimals to get	9·0000d.

£2 6s. 9d. Ans.

4. A.'s farm contains 100·46875 acres, which lacks ·28125 acres of being ¼ as large as B.'s; B.'s farm exceeds 6 times C.'s farm by 5·725 acres. Find the extent of the 3 farms.

	acres.	ac.	ro.	po.
A.'s farm =	100·46875	= 100	1	35
B.'s „ =	(100·46875 + ·28125) × 4	= 403	0	0
C.'s „ =	(403ac. − 5ac. 2ro. 36po.) ÷ 6 =	66	0	34
∴ The extent of the three farms =		569	2	29 Ans.

Grammar.

1. 'Oh, but they say, the words of dying men
Enforce attention like deep harmony.
Where words are scarce, they are seldom spent in vain;
For they breathe truth that breathe their words in pain;
He that no more must say is listened more
Than they whom youth and ease have taught to gloss.
More are men's ends marked than their lives before.'
SHAKESPEARE.

(*a*) Point out the adjective sentences in the above. Show why adjective sentences are so called, and how they are generally joined to the principal sentence.

(*b*) Parse all the participles and infinitive moods that occur in the above.

(*c*) Give the meaning of the above passage in your own words.

(*a*) The adjective sentences are:—
(1) 'that breathe their words in pain.'
(2) 'that no more must say.'
(3) 'whom youth and ease have taught to gloss.'

Adjective sentences are so called because they are joined to some noun or pronoun in the principal sentence, to which noun or pronoun they are attributive, thus No. (1) is attributive to 'they,' No. (2) to 'he,' and No. (3) to 'they.' The connective word is generally a relative pronoun expressed or understood.

(*b*) *dying*—reg. intrans. verb, incomplete part. qual. *men*.
spent—irreg. trans. verb, *spend, spent, spent*, complete part. attrib. to 'they,' and forming pass. voice with 'are.'
say—irreg. trans. verb, *say, said, said*, infin. pres. indef., gov. by must.
listened (to)—reg. trans. verb (now only used transitively with 'to,' complete part. attributive to 'he.'
taught—irreg. trans. verb, *teach, taught, taught*, complete part. forming the pres. perfect tense with 'have.'
to gloss—reg. intrans. verb, infin. pres. indef., gov. by 'taught.'
marked—reg. trans. verb, complete part. attributive to 'ends.'

(*c*) It has been said that very great heed is paid to men's dying utterances, similar to the influence which grand music exercises over men's minds. Men, who say little, generally speak to the purpose, for those who are in trouble speak truly, and he that speaks for the last time is reverenced much more than he who, from various circumstances, has acquired a certain glibness of speech. The end of a man's life comes out more distinctly than any other period of his existence.

2. Give examples to show how the infinitive mood may form (*a*) the subject, (*b*) the object of a sentence.

	Subject.	Object.
(1)	*To walk* in the fields is pleasant.	He ordered him *to stand* aside.
(2)	*To err* is human.	Youth and ease have taught them *to gloss*.
(3)	*To laugh* is better than *to cry*.	I saw the bird *fly*.

3. Give three words compounded with each of the following Latin prepositions:—*ob*, *præ* (pre), *trans* (tres).

Words compounded with *ob*—*ob*stacle, *oc*cur, *op*pose.
" " " *præ*—*pre*dict, *pre*cede, *pre*position.
" " " *trans*—*trans*late, *tres*pass, *tra*duce.

Geography.

Answer *two* questions.

1. Five full notes of a lesson on the St. Lawrence, and the chain of lakes connected with it.

Illustrate by a map, and insert the lines of latitude and longitude.

See under 2nd year.

2. What is a water-parting? Illustrate your answer by reference to the mountain chains of Asia, and the rivers which flow from them in different directions.

A *water-parting* is the spot or line at which the surface-water of a mountain, hill, or swelling-ground parts, and begins to flow down the slope on each side.

The principal water-parting of Asia traverses its central regions in a general north-easterly direction, and sends the rivers in five different directions, corresponding to the five great basins to which they respectively belong. Beginning at the central group of the Hindu Kush, where the rivers rise that flow to the Indian Ocean, *e.g.*, the Indus and the Brahmapu'tra, we may trace the water-parting along the Thian-shan, the Altai, the Yablonoi, and the Stanovoi Mts., N.E. to Behring's St., which throws on the one side the Irtish, Yenesei, and Lena, into the Arctic Ocean, and on the other the Yang-tse Kiang, the Hoangho, and the Amur, into the Pacific. Again the water-parting may be traced westerly to Asia Minor, along the Taurus Mts. by watching the flow of the Euphrates, Tigris, and others southwards, and the Kizil Irmak and others into the Black Sea.

3. Describe fully the course of the River Nile.

The Nile is formed by the union of two streams; the main branch, called Bahr el Abiad, or the White Nile, has its origin in an elevated region of lakes and countless streams, practically in the Victoria N'yanza and Albert N'yanza. Uniting at Khartoum, in Nubia, with the Bahr el Azrek, or Blue River, from Abyssinia, it forms one large stream which flows through Nubia and Egypt, where it is confined between mountain ranges. Near Cairo the valley widens, and the Nile, separating into two great arms, enters the broad plain of the Delta, which it encloses, and falls into the Mediterranean by the western mouth at Rosetta, and by the eastern at Damietta. The length of its course is supposed to be about 3,000 miles. From the junction of the Tacazze or Atbara, 1,740 miles from its mouth, the Nile receives no tributary. Its delta is flat, 90 miles long, and 180 miles of coast. The annual inundations of the river bring down chiefly from the Blue Nile the immense diluvium which fertilizes Egypt.

SECOND PAPER.

Two hours and a half allowed.

History.

1. During the reign of Henry VIII., what changes were made in the Government of Wales and Ireland?

In the reign of Henry VIII., Wales became really united with England (1536). The remains of feudal power held by the barons were abolished, English laws were established, and Welsh members were elected to the House of Commons.

Hitherto Ireland had been styled a lordship of the English crown, but Henry raised it to the rank of a kingdom. From the time of Strongbow, Ireland had never been so thoroughly in a conqueror's grasp than in Henry's time. The power of the crown was acknowledged over the length and breadth of the land. But submission was not all that Henry desired; his aim was to civilize the people, not by force, but by law. But the only law which he or his ministers could frame was that of the English law, which they forced upon Ireland both in civil and religious matters. This action led to those national troubles that have lasted even to the present time.

2. Briefly narrate events which make the following dates remarkable in our history:—1658, 1666, 1679, 1685, and 1715.

Cromwell, worn out by incessant care, died of ague in 1658.

In 1666, the Great Fire of London broke out, and rendered two hundred thousand people homeless. Though the fire caused the loss of St. Paul's Cathedral, yet it burnt out the infection of the plague.

1679 will ever be memorable in our history as the year in which was passed the famous measure called the *Habeas Corpus Act*. This statute secures the personal freedom of all English subjects that obey the law.

1685 is memorable for the unfortunate insurrections of Argyle in Scotland, and Monmouth in England. The Battle of Sedgemoor was followed by the wholesale hanging of the rebels by Judge Jeffreys, in the Bloody Assize.

In 1715, the Earl of Mar raised a rebellion in Scotland in favour of the Pretender, but he was completely routed at Sheriffmuir.

3. In what reigns did the following persons live:—Simnel, Geo. Villiers (Duke of Buckingham), Marlborough, Clive, and Admiral Byng? Tell the history of one of them.

Simnel lived in the reign of Henry VII.; *George Villiers*, in the reigns of James I. and Charles I.; *Marlborough* in the reigns of William III. and Anne; *Clive* and *Admiral Byng* in the reign of George II.

Lambert Simnel, trained to personate Edward, Earl of Warwick, succeeded in his imposture in Ireland, but having tried his fortune in England, he was defeated and captured at Stoke, near Newark, in 1487. He was made a scullion in the royal kitchen.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Hospitality*.

Write, in small hand, as a specimen of copy-setting, *A special tribunal was installed in the citadel.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.

1. If two triangles have two sides of the one equal to two sides of the other, each to each, but the base of one greater than the base of the other; the angle contained by the sides of the one which has the greater base shall be greater than the angle contained by the sides equal to them of the other.

Euclid, I., 24.

2. If a side of any triangle be produced, the exterior angle is equal to the two interior and opposite angles; and the three interior angles of every triangle are together equal to two right angles.

Euclid, I., 2.

3. Equal triangles upon the same base and upon the same side of it are between the same parallels.

Euclid, I., 39.

Algebra.

MALES.

1. Add together $1-(1-\overline{1-x})$, $2x-(3-5x)$, and $2-(-4+5x)$.

$$\begin{aligned} 1-(1-\overline{1-x}) &= 1-1+1-x &&= 1-x \\ 2x-(3-5x) &= 2x-3+5x &&= -3+7x \\ 2-(-4+5x) &= 2+4-5x &&= \underline{6-5x} \\ & & & \underline{4+x.} \text{ Ans.} \end{aligned}$$

2. Find the G. C. M. of—

$$48x^2+16x-15 \text{ and } 24x^3y^2-22x^2y^2+17xy^2-5y^2.$$

Casting out y^2 from the second expression, we have

$$24x^3-22x^2+17x-5$$
$$2$$
$$48x^2+16x-15)\,48x^3-44x^2+34x-10\,(x$$
$$48x^3+16x^2-15x$$
$$-60x^2+49x-10$$
$$-4$$
$$)\,240x^2-196x+40\,(5$$
$$240x^2+80x-75$$
$$-23\;|\;-276x+115$$
$$12x-5$$

Now $48x^2+16x-15=(12x-5)(4x+3)$

∴ $12x-5$ is the G. C. M. Ans.

3. Solve the equations:—

(1) $\frac{4x}{5}-\frac{5x}{4}=-18+\frac{1}{9}(4x+1)$

(2) $\frac{10x+17}{18}-\frac{12x+2}{11x-8}=\frac{5x-4}{9}$

(1) $\frac{4x}{5}-\frac{5x}{4}=-18+\frac{1}{9}(4x+1)$

$$\frac{16x-25x}{20}=\frac{-162+4x+1}{9}$$
$$-81x=-3220+80x$$
$$161x=3220$$
$$x=20.\ \text{Ans.}$$

(2) $\frac{10x+17}{18}-\frac{12x+2}{11x-8}=\frac{5x-4}{9}$

$$\frac{10x+17-10x+8}{18}=\frac{12x+2}{11x-8}$$
$$\frac{35}{18}=\frac{12x+2}{11x-8}$$
$$275x-200=216x-36$$
$$59x=236$$
$$x=4.\ \text{Ans.}$$

Needlework.

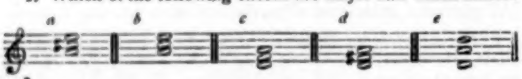
FEMALES.

One hour allowed for this Exercise.

Music.

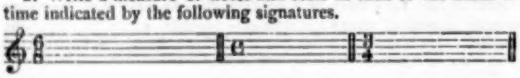
A quarter of an hour allowed for this Paper.

1. Which of the following chords are major and which minor?

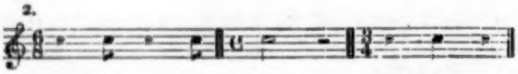


1.

2. Write a measure of notes and rests in each of the kinds of time indicated by the following signatures.

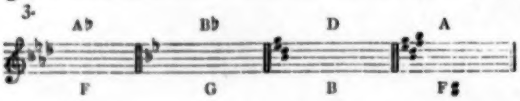


2.



3. Write over each of the following the name of the major scale, and under each that of the minor scale, of which it is the signature.

3.



FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after,* **1st** *May,* **1878; and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. What fraction is a foot and a half of a quarter of a mile? Express the answer as a vulgar fraction, and also decimally.

$1\frac{1}{2}$ ft. to the fraction of 1320 ft. $=\frac{1\frac{1}{2}}{1320}$
$=\frac{3}{2640}$
$=\frac{1}{880}$ or ·001136. Ans.

2. Simplify the expression—

$$\frac{\frac{2}{9}\text{ of }1\frac{2}{3}\text{ of }2\frac{2}{5}}{\frac{7}{9}+\frac{5}{12}-\frac{3}{4}}$$

$$(\tfrac{2}{9}\text{ of }1\tfrac{2}{3}\text{ of }2\tfrac{2}{5})\div(\tfrac{7}{9}+\tfrac{5}{12}-\tfrac{3}{4})=$$
$$\left(\frac{2\times5\times12}{9\times3\times5}\right)\times\left(\frac{36}{28+15-27}\right)=$$
$$\frac{2\times5\times12\times36}{9\times3\times5\times16}=2.\ \text{Ans.}$$

3. Multiply ·0204 by 40·2; divide ·04 by 20, ·4 by ·002, ·0004 by ·0002, and 400 by ·02. Prove the truth of four results by means of vulgar fractions.

(*a*)

```
  ·0204
   40·2
    408
   8160
·82008
```

$$\frac{204}{10{,}000}\times\frac{402}{10}=\frac{82\,008}{100{,}000}=\cdot82008.\ \text{Ans.}$$

(*b*) $\frac{\cdot04}{20}=\frac{4}{100}\div\frac{20}{1}=\frac{4\times1}{2\times1{,}000}=\frac{2}{1000}=\cdot002.$ Ans.

(*c*) $\frac{\cdot4}{\cdot002}=\frac{4}{10}\div\frac{2}{1000}=\frac{4}{2}\times\frac{1000}{10}=$ 200. Ans.

(*d*) $\frac{\cdot0004}{\cdot0002}=\frac{4}{10{,}000}\div\frac{2}{10{,}000}=\frac{4}{2}\times\frac{10{,}000}{10{,}000}=2.$ Ans.

(*e*) $\frac{400}{\cdot02}=\frac{400}{1}\div\frac{2}{100}=\frac{400}{2}\times\frac{100}{1}=$ 20,000. Ans.

4. If the 3 per cent. consols be at $90\frac{5}{8}$, what sum must I invest in order to secure from them a yearly income of £470 after paying an income tax of 5d. in the pound; brokerage being at $\frac{1}{8}$ per cent.?

$$\left.\begin{matrix}£3 & : & £470\\ 235\text{d.} & : & 240\text{d.}\end{matrix}\right\}::£90\tfrac{3}{4}:?$$

$$£\tfrac{363}{4}\times\frac{470\times240}{3\times235}=121\times2\times60=£14{,}520.\ \text{Ans.}$$

FEMALES.

1. At what rate per cent. will £7864 12s. 6d. amount in 5 years to £9175 7s. 11d.?

Interest = £9175 7s. 11d. − £7864 12s. 6d. = £1310 15s. 5d.

$$\left.\begin{matrix}5\text{ yrs.} & : & 1\text{ yr.}\\ 7864\tfrac{5}{8} & : & 100\end{matrix}\right\}::£1310\ 15\text{s.}\ 5\text{d.}:?$$

$$£\tfrac{314585}{240}\times\frac{1\times100\times8}{5\times62917}=£3\tfrac{1}{3}\text{ per cent.}$$

2. Find the present worth of £259 7s. due 4 years hence at $3\frac{1}{2}$ per cent. simple interest.

Simple interest of £100 for 4 years at $3\frac{1}{2}$ p. c. = £14
Amount ,, ,, ,, = £114
∴ £114 : £100 :: £259 7s. : present worth.

$$\frac{£259\ 7\text{s.}\times100}{114}=£227\ 10\text{s.}$$

3. A man bought a cask of sugar containing $2\frac{1}{2}$ cwt. at $4\frac{1}{2}$d. a lb.; allowing $2\frac{1}{2}$ per cent. for waste, what must he sell it at per lb. in order to gain not less than 25 per cent.?

(*a*) $\frac{97\frac{1}{2}}{100}$ of 280 lbs. = 273 lbs.

(*b*) 273 are to be sold for $\frac{5}{4}$ of the price of 280 at $4\frac{1}{2}$d.
i.e. ,, ,, 1575d.
∴ the selling price of 1 lb. = $\frac{1575}{273}$d. = $5\frac{10}{13}$d.
And to gain not less than 25 p. c. the sugar must be sold for 6d. per lb.

4. A, B, and C commence business; A brought £175, B £210, they gained £422 10s., of which C's share was £172 5s. What amount did C put into the business?

(*a*) (£175+£210) gets (£422 10s. – £172 5s.)
or £385 gets £250 5s.

(*b*) ∴ £250 5s. : £172 5s. :: £385 : C's share,

$$\frac{£385 \times 3445}{5005} = £^{265}\tfrac{4425}{5005} = \underline{£265}. \quad \text{Ans.}$$

Grammar.

1. 'We cannot be guilty of a greater act of uncharitableness than to interpret the afflictions which befall our neighbours *as punishments and judgments*. It aggravates the evil to him who suffers, when he looks upon himself as the mark of Divine vengeance, and *abates* the compassion *of those towards him*, who regard him in *so dreadful a light*.' ADDISON.

(*a*) Analyse the above from '*We cannot*' to '*judgments*.'

(*b*) Parse the words in italics.

(*c*) Write out the sense of the above in simple words of your own.

(*a*) (1) 'We cannot be guilty of a greater act of uncharitableness than to interpret the afflictions as punishments and judgments'—(*Principal clause*).

(2) 'Which befall our neighbours'—(*Subordinate adjective clause to* '*afflictions*').

(1) (*a*) We...*subject.*
(*b*) cannot be...*incomplete predicate.*
(*c*) guilty of a greater act of uncharitableness...*adj. phrase completing predicate.*
(*d*) than to interpret the afflictions.. *adv. phrase of comparison extending predicate*
(*e*) as punishments and judgments...*adv. phrase extending predicate and modifying* (*d*).

(2) (*a*) Which...*subject.*
(*b*) befall..*predicate.*
(*c*) neighbours..*simple object.*
(*d*) our...*enlargt. of* (*c*).

(*b*) *As*—subordinative adv. conj. mod. 'interpret' and connecting the phrase 'punishments and judgments' with 'afflictions.'

punishments—abstr. noun, neut., plur., obj. gov. by 'interpret.'

and—co-ord. conj. connect 'judgments' with 'punishments.'

judgments—abstr. noun, neut., plur, obj. gov. by 'interpret.'

abates—reg. trans. verb, indic., pres. indef., 3rd pers. sing. agr. with 'it.'

of—prep. gov. obj. case 'those' which it relates to 'compassion.'

those—demonstr. pron., 3rd pers. com. plur., obj., gov. by 'of.'

towards—prep. gov. obj. case 'him,' which it relates to 'compassion.'

him—pers. pron. 3rd pers. sing, mas. obj., gov. by 'towards.'

so—adv. of deg., mod. 'dreadful.'

dreadful—adj. qual. 'light.'

a—indef. art. or adj. limiting 'light.'

light—abstr. noun, neut. sing. obj. gov. by 'in.'

(*c*) It is unkind as well as unjust to consider men's misfortunes to be a sign of God's displeasure with their conduct. Such thoughts destroy our sympathies with our fellow-creatures, and when the unfortunate themselves look upon their misfortunes in the same light, their miseries are increased tenfold.

2. Point out traces of the Scandinavian element in our language, and state whether it is most nearly allied to the Saxon or to the Latin.

In consequence of the incursions of men of Scandinavian race (who were of the Teutonic stock), many Scandinavian words made their way into common use, and these appear in many names of places in the districts occupied by the Scandinavian invaders, such as *by*, meaning a 'town,' as Grimsby, Whitby, Ho'mby; *Scaw*, a 'wood,' as Scawfell; *force*, a 'waterfall,' as Stockgill Force; *ness*, 'headland,' as in Furness; *ey*, an 'island,' as Bardsey.

Most of the Teutonic elements came in with the Saxons and Angles, but a good many came in with the Danes and Norsemen, that is with the Scandinavians, and of course their language must be more closely allied to the Saxon than to the Latin.

3. Write notes of a lesson on 'Case.'

CASE.—From Lat. *casus*, a falling—an inflection of nouns and pronouns to show the relation which they bear to other words. (Show from examples on black-board how easy it is to know the cases of pronouns, like, *I, mine, me, he, his, him*, even without seeing them in a sentence; but that it is impossible to tell the cases of nouns unless we see them in a sentence. Possessive case, however, easily known; *e.g. John's* hat, *Mary's* bonnet, *Tom's* kite.)

POSSESSIVE CASE.—Formerly formed by adding *es*—thus *boy, boyes;* hound, houndes, etc.—afterwards *e* left out and (') apostrophe put in to mark the omission—(*compare e'er and ever*)—possessive singular takes 's—possessive of plurals ending in *s* take (') only (*examples to be given*). Living beings only, as a rule, take the sign of the possessive—thus, not *the desk's top*, but *the top of the desk.*

NOMINATIVE and OBJECTIVE CASES.—Not known by the look of them when belonging to nouns—*I have a book; A book lies here.* 'Book' has the same look in each sentence, but in the former it is the *object* of *have*, or in *objective* case, and in the second it is the subject of *lies*, or in the *nominative* case (a more appropriate name would be the *subjective* case); transitive verbs take an object after them—nominative found by asking the question Who? or What? with the verb; thus, 'I saw the boy.' *Who* saw the boy? *I, i.e.* the subject—objective case found thus: 'I saw whom'? or 'I saw what'? Ans. *the boy*; therefore *boy* is the object or objective case governed by 'saw.' Objective case follows prepositions, as 'to him,' 'from me,' 'with John.' (*Exercises to be given from reading books; examples dictated by scholars to be written by teacher on black-board.*

Geography.

1. What is a water-parting? Illustrate your answer by reference to the mountain chains of Asia and America, and the rivers which flow from them.

A 'water-parting' is the spot or line at which the surface-water of a mountain, hill, or swelling ground parts, and begins to flow down the slope on each side. Thus the Hindu Kush Mts. form the water-parting between the basins of the Indus and the Amoo, the Himalaya separating the basin of the Ganges from the upper basin of the Brahmaputra, the north-eastern system of Asiatic Mts. separating the river-basins that incline to the Arctic Ocean from those inclining to the Pacific, and embracing (1) the *Thian-Shan*, separating the basins of the Obi and the Yarkand; (2) the *Altai* and *Yablonoi* Mts., separating the basin of the Amoor from those of the Yenesei and Lena; (3), the Stanovoi and Aldan Mts.

In America the Mts. in the northern half of the continent arrange themselves in two grand divisions—an eastern and a western—which are separated from each other by the great central plain; (1), the Alleghanies extend from the Gulf of St. Lawrence to the State of Alabama, and form the water-parting between the basins of rivers flowing eastward into the Atlantic from the two great basins of the Mississippi and the St. Lawrence; (2), the Rocky Mts. extend from the Arctic Ocean to Lake Nicaragua in Central America. The two principal ranges are—1. the Pacific Range, extending along the Western Coast from Alaska to the peninsula of California, and forming the water-parting between the Pacific Ocean on the west, and the Youcon and Rio Colorado on the east. 2. The Rocky Mountain Chain forms a wavy line from the Mackenzie in the Arctic Ocean to near Lake Nicaragua, and separates the basins of the Colville, Youcon, Frazer, Columbia, and Rio Colorado on the west from those of the Mackenzie, Saskatchewan, Missouri, Arkansas, and Rio del Norte on the east.

In South America the Andes, which traverse this continent in its greatest length, form the water-parting which separates the insignificant streams of the Pacific basin from the vast basins of the Amazon and others, comprising the most gigantic rivers on the earth's surface.

2. Draw a full map of the Indian Ocean, and insert the lines of latitude and longitude.

SECOND PAPER.

Two hours and a half allowed.

History.

1. What benefits did this country derive from the Roman Occupation?

When Julius Cæsar came to Britain the inland parts of the country were thinly peopled by a race of warriors who lived by hunting and by herding cattle, and dwelt in huts of wood or wickerwork; their clothes were made of skins; their bodies stained blue. In the south the people were, from intercourse with Gaul, more civilized. Under the Romans their commerce, which was before inconsiderable, improved immensely, and much progress was made in manufactures of bronze and pottery. Although the Romans had been the cause of much bloodshed, yet they did much to improve the condition of the Britons. They taught them how to dress and arm themselves; they had made great military roads; they had built forts; and they had refined the whole British way of living. Above all, it was in the Roman time, and by means of Roman ships, that the Christian religion was first brought into Britain.

2. What events led to the Norman Conquest?

It is said that Edward the Confessor had promised to make William, Duke of Normandy, his successor; and that Harold, who usurped the crown on the death of Edward, had, when he was shipwrecked on the coast of Normandy, sworn to give William his support. Hearing of Harold's election to the vacant throne, William, burning with rage, collected a mighty host, built a great fleet, and made all Europe believe that he was the rightful heir. He prevailed on the Pope to excommunicate Harold, and to send a consecrated banner for his army. Having met Harold's army at Senlac, near Hastings, he totally defeated it, and Harold being killed, William was crowned king on Christmas Day, 1066.

3. In what respects do you consider the people of this country to be better or worse off under Victoria than their forefathers were under Edward I.?

The poorest working man is better off in obtaining the necessaries and even the luxuries of life than the nobles of the reign of Edward. The holding of Parliament, as we now have it, was only beginning, and Edward was accustomed to levy taxes, force loans, which he seldom paid, and demand purveyance. This purveyance shows very strongly the better condition of the people now. Where the king travelled the right of purveyance gave him liberty to force husbandmen to work, or lend their horses for the service of the royal household; and it was customary for farmers to hide their geese and chickens from the rapacity of the king's servants. Now English and Scotch are one; under Edward they were stern foes. The people at the present time are better off for houses, fuel, lighting, clothing, learning (only the very richest, and those who had leisure like the clergy, could read or write), just laws, freedom of religious opinions and worship, sanitary laws, security of person and property, communication between places—in fine, for all the conveniences of life. With a change of time and place, we may say with Tennyson—

'Better fifty years of Europe than a cycle of Cathay.'

Six hundred years must have made vast changes for the better in the civilization of England, though we must confess to an appalling want of civilization in some of the Irish subjects of Her Majesty.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Hospitality*.

Write, in small hand, as a specimen of copy-setting, *A special tribunal was installed in the citadel.*

Composition.

Write a short essay on *The Electric Telegraph and its uses.*

After many untiring experiments and patient investigation, the efforts of scientific men were crowned with success in mastering one of the secrets of nature. It was found that the electricity which works such havoc in thunder-storms could convey messages with the speed of thought over continents and under oceans, communicating instantaneously the information which men wished to convey to each other.

The first line of telegraph was made on the Blackwall Railway, and used at first for the sending of railway signals. After a little the telegraph printed the messages sent, and the telegraphs at first constructed for the use of the railway companies became, by the transmission of public business, a very profitable enterprise.

The use of this wonderful invention spread with amazing rapidity, and soon nations across the sea acquired lines of their own. Dublin was connected with London; Dover with Calais; and in a short time the idea of constructing a submarine telegraph to America became an accomplished fact.

Soon all civilized countries were connected; and poor and insignificant must the nation be that does not now possess a well-employed telegraph system.

In England the State purchased all telegraphs in 1868, and so extended them that every village in the kingdom soon enjoyed the privilege of almost instantaneous communication with every part of the world.

The telegraph has been well characterized as the first human invention which was obviously final. Steam may give way to some yet mightier power; gas is being superseded by a better method of lighting, but no agency can ever excel that which is instantaneous. Here, for the first time, the human mind has reached the utmost limit of its progress.

The union of distant localities by telegraph has quickened the interest which men have in the concerns of each other, and has roused an ever-increasing eagerness for news. The use of the telegraph for informing the Government of what is transpiring at home, in the Colonies, or in foreign countries, cannot be overestimated. The merchant uses it in every branch of his business; in short, it would be difficult to mention where the telegraph is not useful for speedy conveyance of every kind of intelligence.

The telephone has added still more to the power of this wonder of our age.

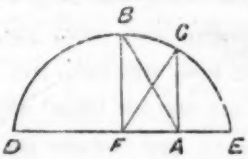
Euclid.

MALES.

Answer two Questions, including (if possible) Q. 1.

[*All generally understood abbreviations for words may be used.*]

1. From any point in the diameter of a semicircle two lines are drawn to the circumference, one to the middle point of the arc, the other at right angles to the diameter. The squares on these lines are together double the square on the radius.



From the point A in the diameter DE of the semicircle DBC, let the two lines AB, AC be drawn, namely AB to B (the middle point of the arc ABC,) and AC at right angles to DE. Then the squares on AB, AC, shall be together double of the square on the radius, *i.e.*, on FB.

Since B is the middle point of the arc DBE, FB is evidently at right angles to DE; therefore

the sq. on BA = sq. on BF + sq. on AF

but the sq. on CA = sq. on FC − sq. on AF

by add. ∴ the sq. on BA + sq. on CA = sq. on BF + sq. on FC

that is, the sqs. on BA and CA = twice the sq. BF (the radius).

Q. E. D.

2. If a straight line be divided into any two parts, the rectangle contained by the whole and one of the parts is equal to the rectangle contained by the two parts, together with the square on the aforesaid part.

(Prop. 3, Book II.)

3. In every triangle, the square on the side subtending either of the acute angles is less than the squares on the sides containing that angle by twice the rectangle contained by either of these sides and the straight line intercepted between the acute angle and the perpendicular let fall upon it from the opposite angle.

(Prop. 13, Book II.)

Algebra.

MALES.

1. Divide $x^3-apx^2+a^2px-a^3$ by $x-a$.

$$x-a)x^3-a^3-ap\,x^2+a^2px(x^2+ax+a^2-apx. \quad \text{Ans.}$$

$$\begin{array}{r} x^3-ax^2 \\ \hline ax^2 \\ ax^2-a^2x \\ \hline a^2x-a^3 \\ a^2x-a^3 \\ \hline -apx^2+a^2px \\ -apx^2+a^2px \end{array}$$

2. Reduce to lowest terms

$$\frac{x^2+(a+c)x+ac}{x^2+(b+c)x+bc} \text{ and } \frac{4x^2-12ax+9a^2}{8x^3-27a^3}.$$

$$\frac{x^2+(a+c)x+ac}{x^2+(b+c)x+bc}=\frac{x^2+ac+cx+ac}{x^2+bx+cx+bc}$$

$$=\frac{(x+c)(x+a)}{(x+c)(x+b)}$$

$$=\frac{x+a}{x+b} \quad \text{Ans.}$$

$$\frac{4x^2-12ax+9a^2}{8x^3-27a^3}=\frac{(2x-3a)(2x-3a)}{(2x-3a)(4x^2+6ax+9a^2)}$$

$$=\frac{2x-3}{4x^2+6ax+9a^2}$$

3. Solve the equations—

$$(1.)\quad \begin{cases} x+y=38\frac{1}{2}-\dfrac{4x+12y}{10} \\ 22y+21x=452 \end{cases}$$

$$(2.)\quad \frac{1}{x-1}-\frac{1}{x+3}=\frac{1}{35}$$

(1.) (*a*) $x+y=38\frac{1}{2}-\dfrac{4x+12y}{10}$

$$10x+10y=382-4x-12y$$

$$14x+22y=382$$

Now (*b*) $21x+22y=452$

∴ by subtracting $7x = 70$

$x = 10$ Ans.

Hence $y = 11$ Ans.

(2.) $\dfrac{1}{x-1}-\dfrac{1}{x-3}=\dfrac{1}{35}$

$$35(x+3-x+1)=(x-1)(x+3)$$

$$140=x^2-3+2x$$

$$x^2+2x=143$$

Completing square $x^2+2x+1=144$

taking root $x+1=\pm 12$

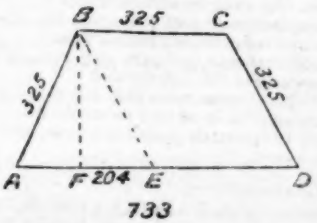
$\therefore x=\pm 12-1=11$ or -13. Ans.

Mensuration.

MALES.

Answer one Question.

1. ABCD is a four-sided figure; BC is parallel to AD; AB =BC=CD=325 feet; and AD=733 feet; find the area.



Through B draw BE parallel to CD, then ABE is an isosceles triangle, and the perp. BF bisects the base AE, which =733—325=408; therefore AF or FE=204.

Wherefore $BF^2=AB^2-AF^2$

$=325^2-204^2$

$=64009$

And $BF=\sqrt{64009}=253$ ft.

Hence the area of the whole figure

$253\times(733-204)=253\times 529$

$=133,837$ sq. ft. Ans.

2. The span of a bridge, whose form is the arc of a circle, being 96 feet, and the height being 12 feet, find the radius.

Rule.—Divide the square of half the span, *i.e.*, 48 ft., by the height of the arc, 12 ft.; this quotient is the difference between the height of the arc and the diameter.

$\frac{48\times 48}{12}=192$ ft.; $192+12=204$ ft., the diameter.

half of 204 = 102 ft., the radius. Ans.

Needlework.

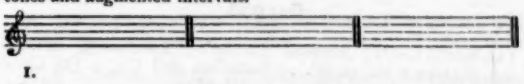
FEMALES.

One hour allowed for this Exercise.

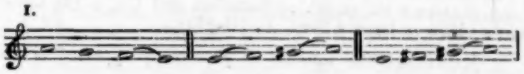
Music.

A quarter of an hour allowed for this Paper.

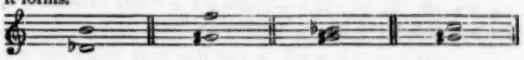
1. Write the upper tetrachord of A (*La*) minor in every form with which you are acquainted. Mark the places of the semitones and augmented intervals.



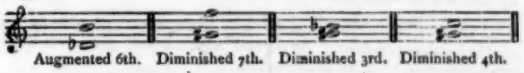
1.



2. Write under each of the following pairs of notes the name and quality (major, perfect, diminished, or other) of the interval it forms.

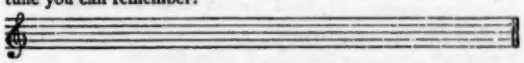


2.



Augmented 6th. Diminished 7th. Diminished 3rd. Diminished 4th.

3. Write, from memory, the first four or more measures of any tune you can remember.



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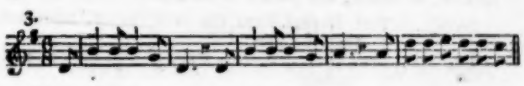


The 'Health at School' Story or Essay Competition.

THE prize, Five Guineas, in this competition has been awarded to

NOVICE,

Thomas Knapman, 5, Avenue Villas, Winchester.

Other competitors—Nil Desperandum I., Nil Desperandum II., Junius Jose.

A. CARPENTER, M.D., *Judge.*

Query Column.

☞ As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month*, or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'*The Query Editor*,'
The Practical Teacher,
Pilgrim Street, Ludgate Hill,
London, E.C.

General.

1. NOVICE.—(1) *Norman Lockyer's* 'Astronomy,' (Primer 1s.), (Larger book, 4s. 6d.), (Macmillan and Co.); (2) *Gardner's* 'How to Draw a Map,' 1s. (Hughes).

2. NAIVETE.—The solution of your query appeared in the March number.

3. LIBER.—Your question appeared in our issue for May.

4. EX. P. T. (J. W.).—There are editions published by Gall and Inglis, and by the National Society.

5. G., Kingston.—You will notice that your query was sent by another correspondent.

6. INQUIRER.—Your query was forwarded previously by another correspondent. Any good algebra will give you a full explanation of 'Scales of Notation.'

7. PEEPING TOM, Coventry.—(1) No charge is made for answering queries; (2) Civil Service Commissioners, Cannon Row, S.W.

8. G. C.—'Seeing him pass, I called him in.'

Seeing.....Part. Imperf. from the verb 'to see,' trans. act., qual. the pro. 'I.'
him.....Pro., pers., 3rd, mas., sing., obj. by the participle 'seeing.'
pass.....Verb, reg., intrans., infin., indef. tense, and governed by the participle 'seeing.'

The phrase 'seeing him pass' is an enlargement of the subject 'I.'

9. MIZPAH.—A billion is a million million; a trillion is a million billion, etc.

In the foreign system of numeration, a thousand million is called a billion, a thousand billion a trillion, and so on.

10. LEO.—The barometer simply informs us what is the pressure exerted by the air at any time and place. This pressure is found to exhibit very great variations from time to time, and one of these is the moisture or dryness of the air. Moist air—that is, air charged with watery vapour—is found to weigh less than an equal bulk of dry air. This seems strange, but the barometer shows us that it is so; and we have a further proof of the fact if we observe the smoke from a chimney. On a fine day the air is heavy, and buoys it up in an almost straight line, while on a damp day it falls heavily. When, therefore, the air is charged with vapour, its pressure diminishes and the barometer therefore falls. We have thus this general rule:—When the barometer is low, wet or windy weather may be expected; and, on the contrary, when it is high, the weather will not improbably be fine.

There are three things which mainly affect the height of the mercury. These are:—

(1) The force of the wind, which produces variations occasionally amounting to as much as two inches.

(2) The amount of moisture in the air. The variations from this cause amount to about half an inch.

(3) The direction of the wind; a north-east wind having a tendency to cause a rise, and a south-west wind a fall. These variations likewise amount to about half an inch.

From this it will be seen that wind affects the barometer much more than moisture does. It is important, then, to notice, together with the height of the barometer, the direction of the wind, and likewise the temperature at the time of taking the observation, as mercury is very sensitive to heat, and expands considerably by it, thereby becoming lighter.

11. STUDENT, Northampton.—The solution of your query appeared in the February No.

12. DANIELL.—

We, pers. pron. 1st pers. com gen., plur., nom. case, subject to verb *are told*.
are told, weak verb, pass. ind. pres. 1st per. plural to agree with its subject *we*.
not, adverb of negation qualifying *are told*.
whither, conjunctive adverb of place, qualifying verb *went* and connecting the sentence *we are not told* to sentence *he went after*, etc.
he, pers. pronoun, 3rd pers. mas. gen. sing. numb. and nom. case to verb *went*.
went, strong intrans. verb. indic. mood, pres. tense, 3rd pers. sing. to agree with its subject *he*.
after, conjunction of time connecting the sentence *he was lost sight of* to the sentence *he went*.
he, personal pronoun, 3rd pers. sing. num. masc. gend. and nom. case to the verb *was lost*.
was lost sight of, trans. weak verb. ind. mood, past tense, 3rd pers. sing. to agree with its subject *he*.
sight may be separately parsed as a noun, and
of as an adverb.

13. LA GRAMMAIRE.—

Any (Saxon œnig), is a derivative from *an, one*
But (A. S. *bútan* or *búton*), means literally 'on the outside of,' being a compound of *be, bi* or *by*, and *útan*, outside.
else, is really *elles*, the genitive of a root *el* or *al*, meaning *other*.

either, is the modern form of the Saxon *aegther*, and means *each of two*, or *on either side one*.
its, is comparatively of modern origin. The old form was *his*, the possessive form of the Anglo-Saxon *hit*.
notwithstanding,=not standing against or opposing.
rather, literally means *earlier*, is the Anglo-Saxon, *rather*, comparative of *rath*, *early*.
therefore, for that reason, from A.S. *thær*, *thære*, genitive and dative of *that*.
thrice, means 'three times,' and is the Old Eng'ish genitive *thrics*.
which, is equivalent to Latin *qualis*, and is a compound of *hwi*, or *hwy*, and *lic*, *like*, in Old Eng'ish was written *whilk*.
what, the neuter of *who* (A.S. hwæt).
yours, belonging to you, is possessive (*eower*) of A.S. *eow*, you.

14. CYMRO.—We should advise you to go through Part V. as it contains a carefully graduated series of exercises based on the book you have already done.

We do not know of any book especially devoted to scanning and parsing. There are chapters on these subjects in most grammars. We will, however, make inquiries.

15. MABEL.—The spouseless Adriatic mourns for her lord, and, her annual marriage (ceremony) being no longer renewed, the Bucentaur, a neglected garment of her widowhood, lies rotting unrestored. St. Mark still sees his lion standing in its old position, but now in mockery of its withered power, over the proud Place where an Emperor sued, and where, when Venice was a queen with an unequalled dowry, monarchs gazed and envied.

16. PUZZLED.—M. Littré says in his large dictionary that the pronunciation of *onze* as if it were preceded by an aspirate arises from the tendency in old French to prefix an *h* to monosyllabic words, and those also in which only one syllable is emphasized, if they commence with a vowel. This, therefore, will account for the *e* of *le* not being elided before *onze*.

17. T. PRICE.—Our days will be calm, our nature bright and happy, when love proves unerring and joy is its own safeguard. They, even now, may hold a blissful course, who, not foolishly bold, live according to the spirit of this creed, and find, in proportion to their need, that other strength (in Religion or in Duty).

18. E. A. LL.—The 'Class-book of Modern Geography' (Philip) is well up to date. We know of none dealing only with Africa. All the latest information with respect to discoveries, etc., will be found embodied in the Report of the Royal Geographical Society, to be obtained, we think, on application to the Secretary, 1, Savile Row, W.

19. CONSTANT READER (Sutton Coldfield).—*Mason* 'English Grammar,' 3s. 6d. (Bell and Sons). *Meiklejohn's* 'History of English Language' (Stewart). *Angus's* 'English Literature' (Religious Tract Society). *Morris's* 'Historical Outline of English Accidence' (Macmillan) is a most useful book.

20. DOUBTFUL.—(*a*) Yes. (*b*) Your writing lacks vigour.

21. J. BARAGWANATH.—At a very early period of our history the King's Court, or *Aula Regis*, sent forth offshoots to relieve itself of certain sorts of cases. One branch, the *Court of Exchequer*, dealing with the Revenue, can be traced back to the reign of Henry I. Another, the Court of Common Pleas, seems to to have originated in that of Richard I. The rolls of the *King's Bench*, formed directly from the *Aula Regis*, date from the same reign.

The Court of Chancery is supposed to have first *definitely* entered upon its career as a Court of Equity in the reign of James I., when the king, speaking in the Star Chamber, said: 'Where the rigour of the law in many cases will undo a subject, then the Chancery tempers the law with equity, and so mixes mercy with justice, as it preserves a man from destruction.' The king gave a practical turn to his words by deciding in favour of Lord Ellesmere when Coke disputed the right of the Chancery to give relief against a judgment obtained by gross fraud and imposition in the Court of Queen's Bench.

22. CANTABRIGIA.—The following will doubtless prove useful:—'Lectures on General Jurisprudence,' by the late *John Austin*, 4th Edition (John Murray). Student's Edition of same, by *Robert Campbell* (John Murray). 'Analysis of Austin's Lectures,' by *Gordon Campbell* (John Murray). 'Institutes of Justinian' (Longmans). 'Institutes of Gaius' (Clarendon Press). *Maine's* 'Ancient Law (Murray). *Hallam's* 'Constitutional History of England' (Murray).

23. W. R.—The following will perhaps make your list more complete:—*Harrison's* 'Conic Sections and Analytical Geometry (Stewart), or *Hann's* 'Analytical Geometry and Conic Sections' (Weale's Series); *Gaze's* '1st and 2nd French Books,' and *Davies'* 'Historical Manuals' for the Special Period.

24. O. D. V.—No, certainly not, he cannot be admitted.

25. TRAINING COLLEGE.—(1) Write to Secretary, Borough Road Training College, S E. (2) Via Latina.

26. LENA.—(1) The managers to whom the school belongs have a right to determine the character of the religious teaching. (2) No distinction is *now* made, but certificated teachers of the third class may take charge of schools of less than 60.

27. SUBSCRIBER, Arbroath.—No; a certificate must be produced from some competent authority stating that the candidate has sufficient knowledge of music.

28. QUEENIE.—St. V. and VI., but we refer you to Art. 40, New Code, for fuller information.

29. SEDGEMOOR.—The boy must be presented in Ex. St. VI. Consult your inspector.

30. J. W. C. A.—There is now no difference. All the necessary subjects must be taken.

31. CONSTANT READER, South Molton.—Will not be published till the close of the year by Messrs. Longmans.

32. A NON-PUPIL-TEACHER.—No; not as a scholar.

33. SHORT SIGHT.—Each case of defect is decided by the medical adviser of the college.

34. M. STEVENSON.—The new Code will be applied in such a case next December.

35. T. D.—'Mental Arithmetic,' *Mansford* (Hughes); 'English Language,' *Angus* (Religious Tract Society); or *Morris* (Macmillan and Co.)

36. FOLKESTONIAN.—Supposing the earth to revolve round the sun in 365·242264 days, explain why leap day should be omitted once in each of three centuries out of every four.

$$365\cdot25 - 365\cdot242264 = \cdot007736.$$

In 400 years this makes a difference of $\cdot007736 \times 400$ or 3·0944 days. We thus see that in 400 years three leap days must be omitted.

Pope Gregory ordered that three of the leap years in every 400 years should be omitted, viz., those which complete a century, the numbers expressing which century, are *not* divisible by four; thus 1600 and 2000 are leap years, but 1700, 1800, and 1900 are not leap years.

Arithmetic.

1. COURCELLES.—A and B together do a piece of work in 11 days, A and C do the same piece of work in 5 days, B and C together do it in 8 days: how long would it take each to do it separately?

A and B can do the work in 11 days,
A ,, C ,, ,, 5 ,,
B ,, C ,, ,, 8 ,,
∴A ,, B can do in 1 day $\frac{1}{11}$ of the work,
A ,, C ,, ,, $\frac{1}{5}$,, ,,
B ,, C ,, ,, $\frac{1}{8}$,, ,,

∴ (By addition)
2(A, B, and C) can do in 1 day $(\frac{1}{11}+\frac{1}{8}+\frac{1}{5})$ of the work.
$= \frac{40+88+55}{440}$ " "
$= \frac{183}{440}$ of the work;
∴ A, B, and C " " $(\frac{183}{440} \div 2)$ of the work
$= \frac{183}{880}$ " "
∴ A can do in 1 day $(\frac{183}{880} - \frac{1}{11})$ of the work $= \frac{103}{880}$ of the work,
B " " $(\frac{183}{880} - \frac{1}{8})$ " " $= \frac{73}{880}$ " "
C " " $(\frac{183}{880} - \frac{1}{5})$ " " $= \frac{1}{176}$ " "
∴ A can do the work in $\frac{880}{103}$ days $= 8\frac{56}{103}$ days,
B " " $\frac{880}{73}$ " $= 12\frac{4}{73}$ "
C " " $\frac{176}{1}$ " $= 176$ " } Ans.

2. G. T. D., Grimsby.—A woman sold 8 dozen apples for 7s. 6½d. Some were sold at the rate of 4 for 3½d. and some at 10 for 11d. How many were sold at each rate?

Average selling price $= \frac{7\text{s. } 6\frac{1}{2}\text{d.}}{96} = \frac{13}{192}\text{q.} = \frac{13}{192}\text{q.}$

Selling price of each in 1st lot $= \frac{3\frac{1}{2}\text{d.}}{4} = \frac{7}{8}\text{d.} = \frac{7}{8}\text{q.}$

" " 2nd " $= \frac{11\text{d.}}{10} = \frac{11}{10}\text{q.} = \frac{33}{32}\text{q.}$

Difference between average price and price of those in 1st lot
$= (\frac{13}{192} - \frac{7}{8})\text{q.} = \frac{121-112}{32}\text{q.} = \frac{9}{32}\text{q.}$

Difference between average price and price of those in 2nd lot
$= (\frac{33}{32} - \frac{13}{192})\text{q.} = \frac{704-605}{160}\text{q.} = \frac{99}{160}\text{q.}$

∴ No. in 1st lot : No. in 2nd lot :: $\frac{99}{160} : \frac{9}{32}$
:: 99 : 45
:: 11 : 5.
11 + 5 = 16. 8 dozen ÷ 16 = ½ dozen.
∴ No. in 1st lot = ½ dozen × 11 = 5½ dozen,
" 2nd " = " × 5 = 2½ " } Ans.

3. KONIEH.—A person, who has invested a certain sum of money for 3½ years at 4½ per cent., finds that, if he had invested it and £100 more for 3 years at 5 per cent., the interest would have been more by £11 5s. than it is now. How much did he invest?

Interest on £100 in 1st case $= £4\frac{1}{2} \times 3\frac{1}{2} = £15\frac{3}{4}$,
" " 2nd " $= £5 \times 3 = £15$;
Difference of interests on £100 $= £\frac{3}{4}$;
But difference of interests on the sum invested $= £15 - £11\ 5\text{s.} = £3\frac{3}{4}$;
∴ Sum invested $= £100 \times \frac{3\frac{3}{4}}{\frac{3}{4}}$
$= £100 \times 5$
$= £500.$ Ans.

4. GEORGINA.—A man expends £1000 in the purchase of Great Nugget shares of £5, when they are at 2 premium, and £500 in the purchase of Agua Frias of £2, when they are at ¼ discount; he sells out again when the Nuggets fall to par and the Agua Frias rise to 3 premium. What does he gain or lose, after paying the broker ¼ per cent. on all the money which passes through his hands? (*Barnard Smith.*)

Brokerage in 1st case = ¼ p. c. on £1000 = £2½;
∴ No. of Great Nugget shares = (£1000 − £2½) ÷ £7
= 997½ ÷ 7
= 142½.
Brokerage in 2nd case = ¼ p. c. on £500 = £1¼;
∴ No. of Agua Frias = (£500 − £1¼) ÷ £(2 − ¾)
= 498¾ ÷ 1¼
= 1995 ÷ 5
= 399.
Selling price of Great Nugget shares = (142½ × 5) £,
" " " Agua Frias = (399 × 5) £,
∴ Total selling price = (541½ × 5) £
= £2707½;
Brokerage = ¼ p. c. on £2707½
= £6·76875
= £6 15s. 4½d.;
∴ Gain = £2707 10s. − £6 15s. 4½d. − £1500
= £1200 14s. 7½d. Ans.

5. YELSERP.—A has £90,000 stock in the 3 p. c. South Sea Annuities, and is offered by Government the choice of being paid off at par at the end of the year, or of receiving £110 of a new 2½ per cent. stock for each £100. He chooses the former alternative, and, on being paid off, is able to invest his money in the 3 per cent. consols at 92. Find the amount of his stock in consols, and the excess of his income above what it would have been if he had agreed to the proposed conversion. (*Barnard Smith.*)

Amount of stock in consols = £90,000 × $\frac{100}{92}$
= £$\frac{9000000}{92}$
= £97,826$\frac{8}{23}$. Ans.

Income in 1st case = £90000 × $\frac{110}{100}$ × $\frac{2\frac{1}{2}}{100}$
= £(275 × 9)
= £2475;
" " 2nd " = £90,000 × $\frac{3}{92}$
= £$\frac{270000}{92}$
= £2934$\frac{16}{23}$;
∴ Excess in income = £2934$\frac{16}{23}$ − £2475
= £459$\frac{16}{23}$. Ans.

6. BORRAS.—A waggon leaves London for Oxford at 5.30 a.m., and travels at the rate of 6 miles an hour. A coach, whose rate is to that of the waggon as 5 is to 3, leaves London some time after, also for Oxford, overtakes the waggon at 10.30 a.m., and proceeds to its destination, where, after remaining an hour, it commences its return journey, and meets the waggon 3¾ miles from Oxford. Find the distance between London and Oxford, and the time (1) when the coach leaves London, (2) when it arrives in Oxford, (3) when it meets the waggon, and (4) when it arrives in London; also the time when the waggon arrives in Oxford.

Rate of coach per hour = ⅗ of six miles = 10 miles.
Distance gone by waggon when overtaken by coach
= (5 × 6) miles = 30 miles;
Time taken by coach to travel this distance = $\frac{30}{10}$ hours
= 3 hours;
∴ Coach left London at 7.30 a.m. (1). Ans.

Coach meets waggon 3¾ miles from Oxford, after remaining 1 hour,
∴ Coach goes 7½ miles farther than waggon, and 1 hour to spare,
∴ Coach could go 17½ miles farther than waggon in the time;
But coach gains (10 − 6) or 4 miles an hour;
∴ Time it takes waggon to travel from the place where overtaken by coach to 3¾ miles from Oxford
= (17½ ÷ 4) hours = 4⅜ hours;
∴ Distance from London to Oxford = (4⅜ × 6 + 3¾ + 30) miles
= (26¼ + 3¾ + 30) miles
= 60 miles. Ans.

∴ Coach arrives in Oxford in 6 hours, that is, at
1.30 p.m. (2). Ans.

∴ Coach meets waggon at 10.30 a.m. + 4¾ hours
= 10.30 a.m. + 4 hrs. 22½ min.
= 2.52½ p.m.
= 7½ min. to 3 p.m. (3). Ans.

∴ Coach arrives in London at 8.30 p.m. (4). Ans.

∴ Waggon arrives in Oxford in 10 hours, that is at
3.30. p.m. Ans.

7. BIRDIE.—If a cottager spends 8s. a week on flour, what difference will it make to him if the wheat rises from £2 10s. 4d. to £2 15s. 1½d. per quarter, if flour rise in the same proportion?

$\frac{\text{£2 15s. 1½d.} - \text{£2 10s. 4d.}}{\text{£2 15s. 1½d.}} = \frac{\text{4s. 9½d.}}{\text{£2 15s. 1½d.}}$
$= \frac{459}{5291}$;

∴ He will obtain $\frac{459}{5291}$ less than formerly, or $\frac{4832}{5291}$ of 8s., or 7s. 3½d. $\frac{4832}{5291}$ q. worth for 8s. Ans.

Note.—32 pecks = 1 quarter.

8. MATHEMATICIAN.—The weekly receipts of a railway company average £2683 7s. 6d. from passenger, and £2117 8s. from goods traffic. The expenses of working are £13,303 7s. 2d. per calendar month. Their capital is 2 millions: what interest can they pay per share of £100? (Barnard Smith.)

Annual receipts = (£2683 7s. 6d. + £2117 8s.) × 52
= £4800 15s. 6d. × 52
= £249,640 6s.
,, expenses = £13,303 7s. 2d. × 12
= £159,640 6s.
Net receipts = £249,640 6s. − £159,640 6s.
= £90,000;

$$\therefore \text{Dividend} = £90{,}000 \times \frac{100}{2{,}000{,}000}$$
$$= £4\tfrac{1}{2}$$
$$= 4\tfrac{1}{2} \text{ per cent.} \quad \text{Ans.}$$

9. E. N.—A person has £2950 in the 3 per cents. at $83\frac{1}{2}$; when the funds have fallen $2\frac{1}{2}$ per cent., he transfers his capital into the 5 per cents. at 108; find the alteration in his income.

Income in 1st case = 3% on £2950
= £29 10s. × 3
= £88 10s.

$$\text{Stock in 2nd case} = £2950 \times \frac{83\frac{1}{2} - 2\frac{1}{2}}{108}$$
$$= £2950 \times \tfrac{81}{108}$$
$$= £2950 \times \tfrac{3}{4}$$
$$= £2212\ 10s.$$

Income in 2nd case = 5% on £2212 10s.
= £110 12s. 6d.
∴ Alteration in income = £110 12s. 6d. − £88 10s.
= £22 2s. 6d. increase. Ans.

10. J. EDWARDS, Burton-on-Trent.—Two bottles of sherry and six pints of ale cost 12s. If the price of the sherry rose 10 per cent., and that of the ale 50 per cent., the cost would be 14s. What was the original price of a bottle of sherry and of a pint of ale?

Cost of 2 bottles of sherry + cost of 6 pints of ale = 12s.
Cost of 2 bottles of sherry (increased $\frac{1}{10}$) + cost of 6 pints of ale (increased $\frac{1}{2}$) = 14s.
∴ Cost of $2\frac{1}{2}$ bottles of sherry + cost of 9 pints of ale = 14s.

(1) ,, 2 ,, ,, + ,, 6 ,, ,, = 12s.
(2) ,, $2\frac{1}{2}$,, ,, + ,, 9 ,, ,, = 14s.
(1) × 3, ,, 6 ,, ,, + ,, 18 ,, ,, = 36s.
(2) × 2, ,, 5 ,, ,, + ,, 18 ,, ,, = 28s.

Subtracting, Cost of $1\frac{1}{2}$ bottles of sherry = 8s.
∴ Cost of a bottle of sherry = 8s. × $\frac{2}{3}$
= 5s. Ans.

Cost of 1 bottle of sherry + cost of 3 pints of ale = 6s.
Cost of 3 pints of ale = 1s.
∴ Cost of a pint of ale = 4d. Ans.

11. N. LEIGH.—If incomes above £150 pay 7d. in the pound income tax, and incomes below £150 pay 5d. in the pound, what income above £150 is practically equal to £149 19s. $11\frac{1}{4}$d.? (*Mansford's* 'Arithmetic.')

s. d. : £ s. d. :: s. d. : Income.
19 5 : 149 19 $11\frac{3}{4}$ :: 19 7 : Income.
12 235 12
233 35249 15 $11\frac{1}{4}$ (£151
233
1194
1165
299
233
66
20
1335 (5s.
1165
170
12
2041 (8d.
1864
177
$177\frac{1}{4} = \frac{709}{4}$.
233

∴ Income = £151 5s. $8\frac{709}{932}$d. Ans.

12. CYMRO GLAN GLOEW.—If 29 oxen would eat up a field of grass in 7 weeks, or 25 oxen would eat up the same field in 9 weeks, the grass growing uniformly, in what time would 32 oxen eat it?

The quantity eaten in 9 weeks by 25 oxen would last (25 × 9) or 225 oxen for 1 week;
The quantity eaten in 7 weeks by 29 oxen would last (29 × 7) or 203 oxen for 1 week;
∴ Quantity grown in 2 weeks would last (225 − 203), or 22 oxen for 1 week;
∴ The growing grass supplies 11 oxen.
∴ Time it would take 32 oxen to eat the grass of the field

$$= 7 \text{ weeks} \times \frac{29 - 11}{32 - 11}$$
$$= \tfrac{18}{21} \text{ of 7 weeks.}$$
$$= 6 \text{ weeks.} \quad \text{Ans.}$$

Note.—(*a*) Writing very fair. (*b*) Yes.

Algebra.

1. SOCRATES.—By selling a horse for £171 I gain as much per cent. as the horse cost me. What was its cost?

Let x = cost of horse in pounds;

$$\therefore x + \left(x \times \frac{x}{100}\right) = 171$$
$$x + \frac{x^2}{100} = 171$$
$$x^2 + 100x = 17{,}100$$
$$x^2 + 100x + (50)^2 = 17{,}100 + 2{,}500$$
$$= 19{,}600$$
$$x + 50 = 140$$
$$x = 140 - 50$$
$$\therefore x = 90.$$

∴ Cost of horse = £90. Ans.

2. W. GREENWOOD.—A merchant buys flannel at 16 pence a yard, and sells it at such a price that he gets for 220 yards as much as he gains per cent. Find his gain per cent.

Let x = gain per cent.;

Cost price of 220 yards = (16 × 220)d.
= 3520d.
= £$14\frac{4}{5}$;

$$\therefore 14\tfrac{4}{5} + \left(\frac{14\frac{4}{5}}{3} \times \frac{x}{25}\right) = x$$
$$14\tfrac{4}{5} + \frac{11x}{75} = x$$
$$1100 + 11x = 75x$$
$$75x - 11x = 1100$$
$$64x = 1100$$
$$\therefore x = 17\tfrac{12}{16}$$
$$= 17\tfrac{3}{16}.$$

∴ Gain per cent. = $17\frac{3}{16}$. Ans.

3. H. W. J.—Extract the square root of 105,404·440241 in the scale of 6, and express the result in the duodenary scale.

10'54'04'44'02'41 (234·521
4
43 | 254
213
504 | 4104
3224
5125 | 44044
42121
51342 | 152302
143124
513441 | 513441
513441

12 | 234
12 | 11...10
0... 7

$$\cdot 521 = \frac{5}{6} + \frac{2}{6^2} + \frac{1}{6^3}$$
$$= \frac{180 + 12 + 1}{216} = \frac{193}{216};$$
$$\tfrac{193}{216} \times 12 = \tfrac{1158}{216} = 10\tfrac{18}{216},$$
$$\tfrac{18}{216} \times 12 = \tfrac{216}{216} = 8\tfrac{8}{216},$$
$$\tfrac{8}{216} \times 12 = 8.$$

∴ 234·521 in the scale of 6 = 7t·188 in the scale of 12. Ans.

4. H. J. BIFFEN.—Solve:—

$$\left.\begin{aligned} x^2+y &= 18 \\ x+y^2 &= 8 \end{aligned}\right\}$$

$$\left.\begin{aligned} x^2+y &= 18 \\ x+y^2 &= 8 \end{aligned}\right\}$$

$$x^2-x+y-y^2 = 10$$
$$x^2-y^2-x+y = 10$$
$$(x+y)(x-y)-(x-y) = 10$$
$$(x+y-1)(x-y) = 10$$
$$= 5\times 2;$$

If we take, $x+y-1=5$, and $x-y=2$, we obtain the values:—$\underline{x=4 \text{ and } y=2.}$

5. EVENLODE.—Solve:—

$$a\frac{a-x}{b}-b\frac{b+x}{a}=x.$$
$$a\frac{a-x}{b}-b\frac{b+x}{a}=x$$
$$a^2(a-x)-b^2(b+x)=abx$$
$$a^3-a^2x-b^3-b^2x=abx$$
$$-a^2x-b^2x-abx=-a^3+b^3$$
$$(a^2+ab+b^2)x=a^3-b^3$$
$$\therefore\ \underline{x=a-b.}$$

6. TRECH CYMRO NA SAIS.—Solve:—

$$\left.\begin{aligned} x+y+z &= 11 \\ x^2+y^2+z^2 &= 49 \\ 2(z-y) &= 3x \end{aligned}\right\}$$

$$\left.\begin{aligned} (1)\quad x+y+z &= 11 \\ (3)\quad 2z-2y &= 3x \end{aligned}\right\}$$

$$\left.\begin{aligned} (1)\ 2x+2y+2z &= 22 \\ (3)-3x-2y+2z &= 0 \end{aligned}\right\}$$

Adding, $\quad -x \quad +4z = 22$

$$\therefore\ z=\underline{\frac{22+x}{4}}$$

Subtracting, $\quad 5x+4y=22$

$$\therefore\ y=\underline{\frac{22-5x}{4}}$$

(2) $\quad x^2+y^2+z^2=49$

$$x^2+\left(\frac{22-5x}{4}\right)^2+\left(\frac{22+x}{4}\right)^2=49$$
$$x^2+\frac{484-220x+25x^2+484+44x+x^2}{16}=49$$
$$x^2+\frac{968-176x+26x^2}{16}=49$$
$$8x^2+484-88x+13x^2=392$$
$$21x^2-88x=392-484$$
$$=-92$$
$$x^2-\frac{88x}{21}=-\frac{92}{21}$$
$$x^2-\frac{88x}{21}+\left(\frac{44}{21}\right)^2=-\frac{92}{21}+\frac{1936}{441}$$
$$=\frac{1936-1932}{441}$$
$$=\frac{4}{441}$$
$$x-\frac{44}{21}=\pm\frac{2}{21}$$
$$x=\pm\frac{2}{21}+\frac{44}{21}$$
$$\therefore\ \underline{x=\tfrac{46}{21} \text{ or } 2.}$$

$$y=\frac{22-5x}{4}$$
$$=\frac{22-5\times\frac{46}{21}}{4} \text{ or } \frac{22-5\times 2}{4}$$
$$=\frac{22-\frac{230}{21}}{4} \text{ or } \frac{22-10}{4}$$
$$=\frac{232}{84} \text{ or } \frac{12}{4}$$
$$=\underline{\tfrac{58}{21} \text{ or } 3.}$$

$$z=\frac{22+x}{4}$$
$$=\frac{22+\frac{46}{21}}{4} \text{ or } \frac{22+2}{4}$$
$$=\frac{488}{84} \text{ or } \frac{24}{4}$$
$$=\underline{\tfrac{122}{21} \text{ or } 6.}$$

$$\therefore\ \underline{x=2 \text{ or } 2\tfrac{4}{21},\ y=3 \text{ or } 2\tfrac{16}{21},\ z=6 \text{ or } 6\tfrac{1}{21}.}$$

7. MATHEMATICIAN.—Solve:—

$$\left.\begin{aligned} xy &= x+y \\ xz &= 2(x+z) \\ yz &= 3(y+z) \end{aligned}\right\} \text{ (Colenso.)}$$

(1) $\quad xy=x+y$
$\quad xy-y=x$
$\quad (x-1)y=x$
$\quad \therefore\ y=\underline{\frac{x}{x-1}.}$

(2) $\quad xz=2(x+z)$
$\quad xz-2z=2x$
$\quad (x-2)z=2x$
$\quad \therefore\ z=\underline{\frac{2x}{x-2}.}$

(3) $\quad yz=3(y+z)$

$$\frac{x}{x-1}\times\frac{2x}{x-2}=3\left(\frac{x}{x-1}+\frac{2x}{x-2}\right)$$
$$\frac{2x^2}{x^2-3x+2}=3\left(\frac{x^2-2x+2x^2-2x}{x^2-3x+2}\right)$$
$$2x^2=3(3x^2-4x)$$
$$=9x^2-12x$$
$$2x^2-9x^2=-12x$$
$$-7x^2=-12x$$
$$7x=12$$
$$\therefore\ \underline{x=1\tfrac{5}{7}.}$$

$$y=\frac{x}{x-1}=\frac{1\frac{5}{7}}{1\frac{5}{7}-1}=\frac{12}{5}=2\tfrac{2}{5}.$$
$$z=\frac{2x}{x-2}=\frac{2\times 1\frac{5}{7}}{1\frac{5}{7}-2}=\frac{24}{-2}=-12.$$

8. MATHEMATICIAN.—Simplify:—

$$\left\{ x^{\frac{1}{2}}y^{-\frac{1}{2}}\sqrt{\left(x^{\frac{1}{2}}y^{\frac{1}{2}}\sqrt{y^{\frac{1}{2}}}\right)}\right\}^3 \text{ (Colenso.)}$$
$$\left\{ x^{\frac{1}{2}}y^{-\frac{1}{2}}\sqrt{\left(x^{\frac{1}{2}}y^{\frac{1}{2}}\sqrt{y^{\frac{1}{2}}}\right)}\right\}^{\frac{2}{3}}$$
$$=x^{\frac{2}{3}}y^{-\frac{2}{3}}\sqrt{\left(xy^{\frac{1}{2}}\sqrt{y}\right)}$$
$$=x^{\frac{2}{3}}y^{-\frac{2}{3}}\sqrt{\left(xy^{\frac{1}{2}}\times y^{\frac{1}{2}}\right)}$$
$$=x^{\frac{2}{3}}y^{-\frac{2}{3}}\sqrt{xy^2}$$
$$=x^{\frac{2}{3}}y^{-\frac{2}{3}}\times x^{\frac{1}{2}}y$$
$$=\underline{x^{\frac{7}{6}}y^{\frac{1}{3}}.} \text{ Ans.}$$

9. J. BARAGWANATH.—Solve:—

$$\sqrt{1+x+x^2}+\sqrt{1-x+x^2}=3x. \quad (\textit{Hall's 'Algebra.'})$$
$$\sqrt{1+x+x^2}+\sqrt{1-x+x^2}=3x$$
$$1+x+x^2+2\sqrt{(1+x+x^2)(1-x+x^2)}+1-x+x^2=9x^2$$
$$2\sqrt{1+x^2+x^4}=9x^2-2x^2-2$$
$$=7x^2-2$$
$$4(1+x^2+x^4)=49x^4-28x^2+4$$
$$4+4x^2+4x^4=49x^4-28x^2+4$$
$$4x^4-49x^4=-28x^2-4x^2$$
$$-45x^4=-32x^2$$
$$45x^2=32$$
$$x^2=\tfrac{32}{45}$$
$$\therefore\ x=\pm\sqrt{\tfrac{32}{45}}$$
$$=\underline{\pm\tfrac{4}{15}\sqrt{\tfrac{2}{5}}.}$$

10. DISCO.—Find the sum of the series:—

$$21^2+22^2+\ldots\ldots+100^2$$

$$1^2+2^2+3^2+\ldots\ldots+n^2=\frac{n(n+1)(2n+1)}{6}$$

$$21^2+22^2+\ldots\ldots+100^2$$
$$=1^2+2^2+\ldots\ldots+100^2-(1^2+2^2+\ldots\ldots+20^2)$$
$$=\frac{100(100+1)(200+1)}{6}-\frac{20(20+1)(40+1)}{6}$$
$$=\frac{\overset{50}{\cancel{100}}\times 101\times\overset{67}{\cancel{201}}}{\underset{1}{\cancel{6}}}-\frac{\overset{10}{\cancel{20}}\times\overset{7}{\cancel{21}}\times 41}{\underset{1}{\cancel{6}}}$$
$$=338,350-2,870$$
$$=\underline{335,480.} \text{ Ans.}$$

11. ALPHA.—A train starts with its full complement of passengers. At the first station it drops one-third of these, and takes in 96 more; at the next it drops one-half of the new total, and takes in 12 more. On reaching the third station there are found to be 248 left. What number started?

Let x = no. of passengers at first,

Then $\frac{2x}{3}+96$ = no. left after first station;

$\therefore \frac{1}{2}\left(\frac{2x}{3}+96\right)+12=248$

$\frac{x}{3}+48+12=248$

$\frac{x}{3}=248-60$

$=188$

$\therefore x=564.$

$\therefore$ No. of passengers at first = 564. Ans.

Mensuration.

1. DEWI.—A cask weighing 2 cwt. 12 lbs. 4 oz. floats in a cubical cistern of water, whose side is five feet. On the removal of the cask find how much the water will sink in the cistern, supposing a cubical foot of water to weigh 63 lbs.

Surface of cistern = (5^2) sq. ft. = 25 sq. ft.

Space occupied by cask = $\frac{2 \text{ cwt. } 12 \text{ lbs. } 4 \text{ oz.}}{63 \text{ lbs.}}$ cub. ft.

$=\frac{236\frac{1}{4}}{63}$ cub. ft.

$=\frac{945}{252}$ "

$=\frac{15}{4}$ "

$\therefore$ The water will sink $(\frac{15}{4}\div 25)$ ft.

$=\frac{3}{20}$ ft.

$=\frac{1}{7}$ in.

$=1{\cdot}8$ in. Ans.

2. ZNERRUX.—A cylindrical reservoir, whose diameter is 10 feet and height 10½ feet, is supplied by two pipes. One of them alone could fill it in 20 minutes, and water flows in through the other at the rate of 200 gallons a minute. If both pipes are opened simultaneously, how long will they take to fill the reservoir, supposing the volume of a gallon of water to be 277·25 cubic inches?

Content of reservoir = $(10^2 \times {\cdot}7854 \times 10\frac{1}{2})$ cub. ft.

$=(78{\cdot}54\times 10\frac{1}{2})$ "

$=(785{\cdot}4+39{\cdot}27)$ "

$=824{\cdot}67$ cub. ft.

$\therefore$ Reservoir will hold $\frac{824{\cdot}67\times 1728}{277{\cdot}25}$ gals.

$=\frac{142502976}{17725}$ gals.

1st pipe will fill in one minute $(\frac{1}{20}$ of $\frac{142502976}{17725})$ gals.

$=\frac{71251488}{177250}$ gals.

Both pipes will fill in 1 min. $(200+\frac{71251488}{177250})$ gals.

$=\frac{106876744}{177250}$ gals.

$\therefore$ Reservoir will be filled by both pipes in

$(\frac{142502976}{17725}\div\frac{106876744}{177250})$ min.

$=\left(\frac{142502976}{17725}\times\frac{177250}{106876744}\right)$ min.

$=\frac{5}{63350744}\left(\frac{142502976}{17725}\times\frac{177250}{106876744}\right)$ min.

$=11{\cdot}247\ldots$ min. Ans.

3. GULIELMUS.—A map is drawn on a scale of ¼ of an inch to the square mile, and is 6 feet 5 inches long and 3 feet 6 inches broad; find the area of a map drawn on a slate which is 15 inches long and 6 inches broad, on the largest scale which the slate will permit. Find also the scale on which it is drawn.

ft.	in.	in.	ft.	in.	
3	6	: 6	: :	6	5 : To leng h of map on slate
12		12			
42		77			
7		11			

$=11$ in.

$\therefore$ Area of map on slate $=(11\times 6)$ sq. in.

$=66$ sq. in. Ans.

Area of map = 6 ft. 5 in. × 3 ft. 6 in.

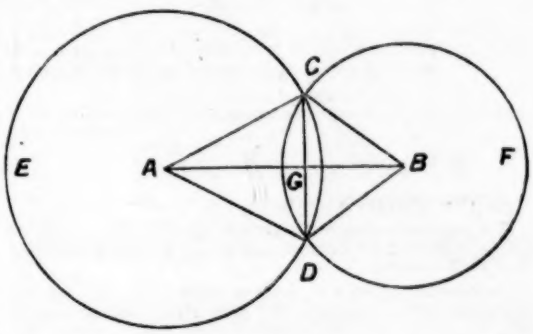
$=(77\times 42)$ sq. in.

$\therefore$ Scale of map on slate $=\frac{\overset{6}{66}}{77\times\underset{7}{42}}$ of ¼ sq. in. to the sq. mile.

$=\frac{1}{49}$ sq. in. to the sq. mile. Ans.

Geometry.

1. O. H. F.—If two circles cut each other, the line joining their points of intersection is perpendicular to the line joining their centres.



Let the two circles CDE, CDF intersect at the points C, D, and let CD be joined, also A, B, the centres of the circles.

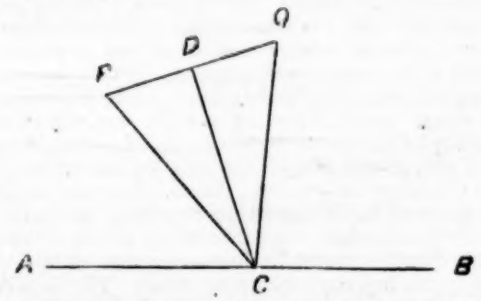
Then CD shall be perpendicular to AB.

Let G be the point of intersection of AB, CD, and draw AC, AD, BC, BD.

Proof.—In the triangles CAB, DAB, the two sides CA, AB = the two sides DA, AB, each to each,
and the base BC = the base BD, (Def. 15.)
$\therefore \angle$ CAB = $\angle$ DAB. (I. 8.)

Again, in the triangles CAG, DAG, the two sides CA, AG = the two sides DA, AG, each to each,
and $\angle$ CAG = $\angle$ DAG,
$\therefore$ the base CG = the base DG, (I. 4)
and $\angle$ AGC = $\angle$ AGD;
and these are adjacent angles;
$\therefore$ AG is perpendicular to CD. (Def. 10.)
Wherefore CD is perpendicular to AB. Q.E.D.

2. BRETWALDA.—Find the point C, in a given right line AB, from which two equal right lines can be drawn to two given points, P and Q.

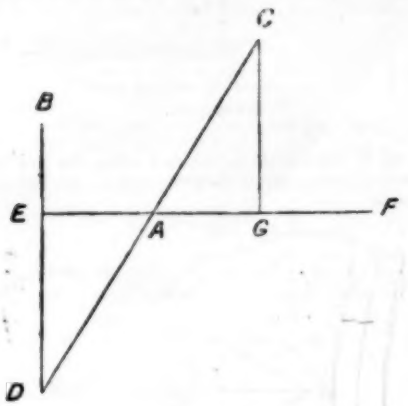


Construction—Join PQ; bisect it in D, and from D draw DC at right angles to PQ, cutting AB in C.

Then C shall be the required point in AB.
Join CP, CQ.

Proof.—In the triangles CDP, CDQ, the two sides CD, DP = the two sides CD, DQ, each to each,
and the angle CDP = the angle CDQ, (Ax. 11.)
$\therefore$ Base CP = base CQ. (I. 4.) Q. E. F.

3. J. GUILD.—Through a given point to draw a straight line, so that the parts of it intercepted between that point, and the perpendiculars upon it from other two given points, may be equal.



Let A, B, C be the three given points.

It is required to draw a straight line through A, so that the parts of it intercepted between A and the perpendiculars from B, C shall be equal.

Construction.—Join CA, and produce it to D, making AD equal to CA; join BD, and draw EAF perpendicular to BD.

Then EF shall be the required straight line.

Draw CG perpendicular to EF.

Proof.—In the triangles ACG, ADE,

$\angle CAG = \angle DAE$, (I. 15.)

$\angle CGA = \angle DEA$, (Ax. 11.)

and side CA = side DA, (Con.)

$\therefore$ side AG = side AE. (I. 26.) Q. E. F.

4. DANEBURGH.—Show that the square on the sum of two straight lines, together with the square on their difference, is double the squares on the two lines.

This is identical with Prop. X., Bk. II.

Monthly Notes.

LONDON SOCIETY FOR TEACHING THE BLIND.—The annual meeting of this society was held, lately, at Willis's Rooms, St. James's, and was numerously attended. Mr. Richardson Gardner, M.P., occupied the chair.—The Rev. C. Camp read the report, which stated that the number of pupils now in the school is 31 males and 26 females. Of the males, 3 are engaged in basket-making, 7 in chair-caning, 8 in piano-tuning, 12 are receiving musical instruction, and 3 are employed in the embossing department. Of the females, 13 are receiving musical instruction. The institution, the report stated, does not exercise any power of selection of the fittest candidates, but opens its doors to all who possess simple capacities for instruction.—The Chairman said, as some contradictory statements had appeared in the newspapers regarding the legacies left by Mr. Gardner, his father-in-law, for the benefit of the blind, it might be interesting that he should state exactly how the matter really stood. The amount of the legacy was £300,000, besides £10,000 each to three different institutions, of which this was one. A friendly suit was instituted in Chancery with regard to the £300,000, and a scheme had been propounded by the Court. The interest of the whole sum was about £9,000 a year, which, by the scheme, was to be divided into thirds—one-third to be devoted to musical instruction, one-third to instruction in handicrafts, and one-third in pensions for those who could not support themselves. He was himself somewhat of a specialist in matters relating to the blind, he having, in company with his wife, spent a twelvemonth in visiting the various institutions for the blind on the Continent, some of which were very well managed, but he believed there was none more efficiently managed than this.

YORKSHIRE COLLEGE.—It has been decided to found a chair of physics in the Yorkshire College, as a memorial to the late Lord Frederick Cavendish, who was for some time President of that institution.

NATIONAL UNION OF ELEMENTARY TEACHERS.—We take the following from Mr. Heller's report to the Executive of the National Union of Elementary Teachers:—'I have ascertained from the Secretary of the Education Department that the question as to the interpretation of the term "average attendance" under Arts. 15, 18, and 96 (*a*), (*b*), is still under consideration, and has not been definitely settled by the Department. I have also ascertained that the report of my previous interview with Sir Francis Sandford respecting the use of geographical readers and the revision of a member's certificate is substantially accurate. The member should be advised to forward his certificate to the Department through the managers. I have further to report that if a certificate has not been sent up for revision at the end of ten years it is open to the managers to submit it to the Department for that purpose. I am further authorised to say that during the transitional period the production of geographical readers will not be fully insisted upon if it can be shown that good text-books on the subject are in use. The Department have still under consideration the recognition of the geographical reader as one of the three sets required in a school. I also gather that Art. 113 (*b*), (i), and (iv) New Code, relating to evening schools, does not mean that a night school pupil may be examined if he has attended at all during the eight weeks. The wording of the article is somewhat obscure; but the intention of the Department is that the scholar should have been in attendance regularly during the period named.'

Gossip.

We beg to remind our readers that the new offices of the National Union of Elementary Teachers are at 57 and 58, Chancery Lane, W.C. The rooms placed at the disposal of the Union are light, commodious, and convenient, and form part of a noble building in the heart of the metropolis.

***

Secretaries of local associations could doubtless add greatly to the enjoyment of Mr. R. Greenwood's holiday by paying in their subscriptions promptly. The respected Treasurer of the Union cannot have a very easy mind just now.

***

Mr. Robinson, of Newcastle-on-Tyne, will publish, early in autumn, a choice collection of Bewick's wood engravings, executed between 1812 and 1828. Mr. Robinson will prefix an introduction containing much interesting and original matter, with notes and biographical sketches, and a catalogue of the principal Bewick works.

***

Mr. Hablot K. Browne, better known as 'Phiz,' under which name he designed the illustrations for Dickens's

'Pickwick Papers,' in 1835, died on the 8th July. He was born in 1815, and drew comic pictures at a very early age. He illustrated most of Dickens's works, besides making drawings for comic serials and well-known novels.

***

Messrs. W. H. Allen and Co. have just published, in two octavo volumes, an edition of the Plays and Poems of Charles Dickens.

***

Mr. A. C. Swinburne's new volume, 'Tristram of Lyonesse,' and other poems, has just been published by Messrs. Chatto and Windus. It contains some poems relating to child life, which all admirers of one of our greatest living poets will be glad to read.

***

Mr. Burton has bought the Velasquez portrait of Philip IV., at the Hamilton Sale, for the National Gallery, at a price of £6,300.

***

Messrs. W. Blackwood and Sons have recently published a very interesting work by Lt.-Col. B. D. W. Ramsay, entitled, 'Rough Recollections of Military Service and Society.' The book abounds in amusing anecdotes, not only of military life, but of literary notabilities and events, and is well worth reading. One anecdote of the late Earl of Beaconsfield is singularly good. It seems that Mr. Murray, of Albemarle Street, was accustomed to give a dinner to his literary friends every Christmas. The elder Disraeli and his family were always there, together with others. After dinner the young people used to have a round game together, but no one would play with Master Benjamin, *because he cheated so.* Perhaps it was not exactly cheating so much as cleverness, but the story shows that Lord Beaconsfield was as desirous of having the upper hand then as when he had become Prime Minister of England. It is only one more example of the truth of Wordsworth's famous saying, 'The child is father of the man.'

***

In the same book is a capital story of Wordsworth. Col. Ramsay was once travelling in a railway carriage with Wordsworth and his sister, together with a little girl who, soon after leaving some station or other, burst into tears. 'Both the old poet and his sister were much concerned, and began to question her as to the cause of her tears. It then appeared that the poor little thing ought to have got out at the last station, but had been asleep. Wordsworth and his sister, both actuated by the same kind intentions, put their heads out of the window, shouting, "Guard, guard! stop, stop!" I mildly pointed out to them that they were shouting to the wind alone, and that it was very dangerous, on which they subsided; but at the next station there was much talking to the guard on the departure of the little girl.'

***

Sir William Armstrong has given £5,000 towards completing two wings and corridors of the new Natural History Museum at Newcastle, and his wife has given £1,000 more to the general building fund.

***

Messrs. Griffith and Farran will publish immediately, under the title of 'Talks about Science,' a collection of popular lectures on Science by the late Thomas Dunman. Mr. Charles Welsh will contribute a prefatory memoir.

***

The second edition of Mr. Halliwell-Phillipps's 'Outlines of the Life of Shakspere' has just been issued by Messrs. Longmans.

Training Colleges.

GENERAL EXAMINATION, 1881.

SECOND YEAR.

MALE AND FEMALE CANDIDATES.

Music.

Two hours allowed for this paper.

The Tonic Sol-fa questions are printed in Italic. Candidates must keep *entirely* to one set of questions or the other. *You are not permitted to answer more than* NINE *questions.*

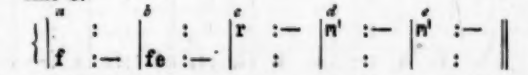
1. Of how many and what scales does this note form a constituent part?

1. *In how many and what keys does G* (Soh) *form a constituent part?*

2. Write above *a* its perfect fourth; above *b* its perfect fifth; below *c* its major third; below *d* its minor sixth; and below *e* its octave.

2. *Write above* a *its perfect fourth; above* b *its major third; below* c *its major third; below* d *its minor sixth; and below* e *its octave.*

KEY C.



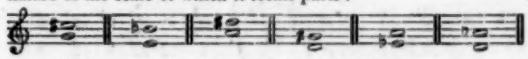
3. What intervals are classed as major and minor, and what as perfect and imperfect, and perfect and pluperfect?

3. *What intervals are classed as major and minor, and what as perfect and imperfect, and perfect and pluperfect?*

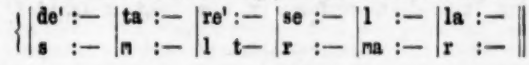
4. Is there any arrangement of a minor scale wherein an interval greater than a tone is employed?

4. *Is there any form of the minor scale wherein an interval greater than a tone is employed?*

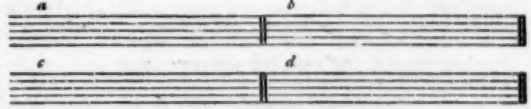
5. Write before each of the following pairs of notes the signature of the scale of which it forms parts:—



5. *Write over each of the following pairs of notes the name of the scale to which it would belong if not written chromatically:—*



6. Write in *a* the average notes of the Treble voice; in *b* those of the Contralto; in *c* those of the Tenor; and in *d* those of the Bass.

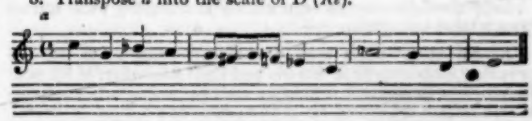


6. *Write the average compass of the Treble, Contralto, Tenor, and Bass voices.*

7. What are the strong beats in a measure of $\frac{3}{4}$ time?—in a measure of $\frac{6}{8}$ time?

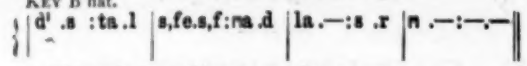
7. *Where do the strong beats occur in three-pulse, and in six-pulse measure?*

8. Transpose *a* into the scale of D (*Re*).

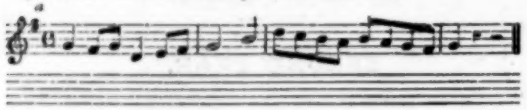


8. *Transpose the following into the key of D* (Re) :—

KEY B flat.

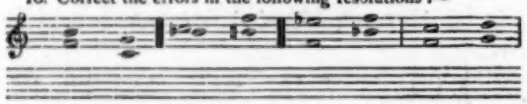


9. Write *a* in time of four quavers in a measure.



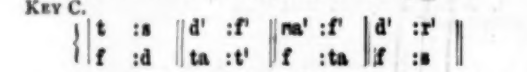
9. *Write a scale* (1) *in two-pulse measure,* (2) *in three-pulse measure, and* (3) *in four-pulse measure.*

10. Correct the errors in the following resolutions :—

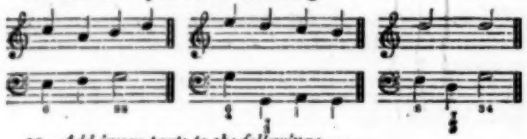


10. *Correct the errors in the following resolutions :—*

KEY C.

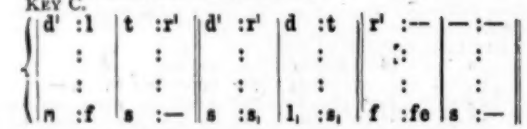


11. Add inner parts to the following :—

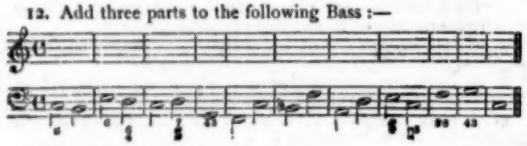


11. *Add inner parts to the following :—*

KEY C.

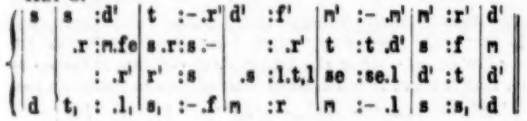


12. Add three parts to the following Bass :—



12. *Analyse the following :—*

KEY C.



SCOTLAND.

Special Paper for Graduates examined under Article 48 (*a*) *of the Scotch Code.*

SCHOOL MANAGEMENT.—No. 2.

Three hours allowed for this Paper.

Section I. and II. *must* be answered : not more than one question is to be worked in each of the other Sections.

SECTION I.

Copy the following passage clearly and legibly with correct punctuation and spelling :—

All his oth er labers were graddualy leeding up to this the crouning atcheevment of his life and cheif fondashun of his faim in relligious litteratur it is unicque vaste empossing and exaustive it rose beffore the eys of his contimprarys as a tempel of devine filossofy in which all knowlege natral and suppernattural found its plaice acording to one of his grate admirrers evry artical in it was mirraclouse as many artice's so menny mirackles yet its principle excelance lys in its arangment and comprehensivness one serches it in vane for anything origginel whither of conseptin methid or docktrin it is but a sistimattic welting togither and filing up of what lyes scattereed in the writter's preveous volumns hear evrything is bound toggither in an organnic hole with incomparrible luccicddety and proporrision it remminds one of nothing so much as of sum collosal forrest-tree rammyfying on evry side from the mascive collum of the trunc threw a maize of hudge lims and lesser branshes.

SECTION II.

(*a*) State what you know about the various systems adopted in elementary schools for teaching writing.

(*b*) Write in *large hand*, as a specimen of copy-setting, the words, 'Characteristics of immutability.'

(*c*) Write in *round hand*, as a specimen of copy-setting, the words, 'Elliptical exercises.'

(*d*) Write in *small hand*, as a specimen of copy-setting, the sentence :—

'The plumage of birds is periodically renewed.'

SECTION III.

What do you mean by 'Notes of Lessons?' What use ought to be made of them in teaching? Draw up full notes for an introductory lesson on *one* of the following :—

1. A class is beginning simple division: explain clearly each step in the process, and show how *division* is a short method of working *subtraction*.

2. Decimal fractions, explaining fully the rule for pointing (*a*) in multiplication (*b*) in division.

3. The present worth of £838, due 19 months hence, at 3 per cent., simple interest, is £800. Explain fully each step in the process of working the sum.

SECTION IV.

1. Explain clearly and simply, in the form of notes of a Lesson to an advanced class, the meaning of Principal, Rate per cent., Interest, Simple and Compound, Discount, and Brokerage. Illustrate your answer by suitable examples.

2. I sell £7,300 out of the 3 per Cents. at 96, and invest my money in 5 per cent. Bank Stock at £105 13s. 4d. Find the difference in my income.

Solve this question, explaining fully each step in the process.

3. Define a recurring decimal. How many kinds of them are there? What kind of vulgar fractions always give recurring decimals?

Multiply ·7575 by ·366, and explain fully each step in the process.

SECTION V.

Draw up full notes for a Lesson to an upper class on *one* of the following :—

1. Magna Charta, the Solemn League and Covenant, the Habeas Corpus Act, and the Bill of Rights.

2. The state of the Highlands before and after the Rebellions of 1715 and 1745, and the cause of the change.

3. The influence of the French Revolution on the policy of Britain. The wars in which it involved this country, and the rise and extent of the National Debt.

SECTION VI.

1. A class of children, who know nothing of geography, is before you. Give full notes of your *first* lesson on this subject, and a scheme of your future course of instruction.

2. Describe, as you would to an advanced class, the position and extent of Australia, the different colonies into which it is subdivided, their relative situations, and the physical features, the climate and natural productions, of *one* of them.

3. State what you know about the Overland Route to India, the time occupied in effecting it, and the modern improvements to which it has given rise in Egypt. Arrange your answer in the form of a lesson to a pupil teacher.

SECTION VII.

1. (*a*) Describe, briefly, the means by which you would impart *the first elements* of grammar to children.
(*b*) At what stage in their progress should you commence this part of their instruction?

2. (*a*) In how many ways can you parse the words *that* and *what*, respectively? Make examples to illustrate your distinctions.
(*b*) Show, by examples, the *forms*, *use*, and *government* of participles in English.

3. (*a*) Explain, briefly, as if to a class, the distinction between 'simple,' 'compound,' and 'complex' sentences, and give an example of each.
(*b*) Make out a detailed analysis of the following passage:—

'Sweet Auburn! parent of the blissful hour,
Thy glades forlorn confess the tyrant's power.
Here, as I take my solitary rounds,
Amidst thy tangling walks and ruined grounds,
And, many a year elapsed, return to view
Where once the cottage stood, the hawthorn grew,
Remembrance wakes, with all her busy train,
Swells at my breast, and turns the past to pain.'

SECTION VIII.

The following passage having been prescribed as a reading lesson to your first class, what notes and illustrations would you consider necessary for your guidance?

'The year 1848 was characterised by political convulsions on the continent of Europe. On the 24th February a revolution commenced in France, by a general rising of the people against the sovereign, Louis Philippe. He fled from the storm which was gathering around him, and took refuge in England. The people declared France a Republic, and eagerly proceeded to demolish all traces of monarchical government, with singular forbearance, however, towards the lives of individuals. The shock spread throughout Prussia, Austria, Italy; and, indeed, in almost every state of Europe there was a momentary struggle for more constitutional government and popular freedom.

'A speedy reaction, however, rendered the monarchs of these states more absolute than ever. After some disturbances, not quelled without bloodshed, the French nation elected Louis Napoleon, nephew of Napoleon Bonaparte, President of their Republic, and tranquility generally prevailed. Again, on the 21st and 22nd of November, 1852, the President was elected Emperor, by nearly eight million votes, and took the title of "Napoleon III., Emperor of the French." After a reign of eighteen years, he declared war on Prussia, but, defeated in several battles, and worn out in mind and body by his reverses, he found himself at last compelled to give up his sword to the king of Prussia.'

—o—

Publications Received.

Biography—

(1) Dicey's Victor Emmanuel. Marcus Ward and Co.

Chemistry—

(1) Volckxsom's Catechism of Modern Elementary Science. Kegan Paul, Trench and Co.

Domestic Economy—

(1) Greenup's Fifty Things to be Remembered in the Kitchen. Marcus Ward and Co.

Drawing—

(1) Imperial Drawing Books. T. Murby.

French—

(1) Jerrain's Miscellaneous Sentences for Translation into French. Longmans and Co.

Geography—

(1) Hughes's Elementary Class-book of Physical Geography. G. Philip and Son.
(2) Blackie's Geographical Readers, I. to III. Blackie and Son.

Grammar—

(1) Morrison's English Grammar. Gall and Inglis.

History—

(1) Comprehensive Historical Readers. Blackie and Son.
(2) Readings in English History. T. Murby.
(3) Scale of Nations. W. H. Guest.

Latin—

(1) Latin Course. W. and R. Chambers.

Mathematics—

(1) Mensuration for Beginners. T. Murby.
(2) Dodd's Inspector's Test Sums. T. Murby.

Miscellaneous—

(1) Digby's Hothouse Education. E. Stanford.
(2) Walter's Matriculation Classics. W. K. Lewis.
(3) Howitt's Visits to Remarkable Places. Longmans and Co.
(4) W. M. S. S. Union Annual Report. W. M. S. S. Union.
(5) Hulme's Art Inspection in England. Longmans and Co.

Music—

(1) Johnson's Day School Song Book. Bemrose and Son.

Periodical Literature—

(1) Universal Instructor, XXI. Ward, Lock and Co.
(2) Our Little Ones, IX. Griffith and Farran.

Prize Books—

(1) Gammon's Italy's Liberator. S. W. Partridge.

Science—

(1) Unwin's Elements of Machine Design. Longmans and Co.

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Publications Reviewed.

*** We are sorry to disappoint the many friends who desire us to quote the price of each work noticed in our columns. This we would respectfully point out is the publishers' duty and not ours; we give publicity enough to a book when we review it. Our readers should peruse the advertisements in our pages, and failing to find the price here, it would be no great trouble or expense to drop a line to the publishers, whose name and address we will gladly give.

The Epoch of Reform, 1830-1850. By Justin McCarthy, M.P. London: Longmans and Co.

Mr. McCarthy gives us in his dates to understand fully what he means by the Reform Epoch. We have no desire to cavil at the enlargement of the most important peaceable revolution that was ever effected in our country; but the overwhelming interest and intense excitement that marked the Reform agitation from the memorable 1st of March, 1831, when the Bill was introduced, to the more memorable 7th of June, when it received the Royal assent, has not been equalled by the agitation of any subsequent measure. The struggle for free-trade was great and remarkable, but was comparatively smooth and placid to the rushing wave of the Reform excitement. Doubtless that victory paved the way for the great practical reforms that Mr. McCarthy describes with clearness and ability. The crying evil of slavery was first attacked by the reformed Parliament, and soon practically settled. Municipal reform followed, and the growing evil of pauperism was repressed, and the Poor Laws thoroughly amended. The greatest of practical modern measures—the abolition of the Corn Laws—followed, and though the contest was somewhat prolonged, the victory was thereby more thoroughly secured by the people being fairly instructed in the sound maxims originated by Adam Smith, and further expounded by Bentham. After the citadel of personal sovereignty, somewhat mingled with oligarchical power, was yielded by the Reform Act of 1832, the outworks that frowned upon popular power and defended class privileges were successively surrendered without serious resistance. All this is well told by Mr. McCarthy, and we know of no fairer or more trustworthy guide to the history of what Miss Martineau happily called the 'Thirty Years' Peace' than the compendium before us

A Compendium of Italian History. From the Fall of the Roman Empire to the Present Time. By J. D. Morell, LL.D. London: Longmans and Co.

The mass of this history is a translation and compilation from Bosco's *La Storia d'Italia*, which is pretty extensively used throughout Italy. Dr. Morell wisely omits the earlier portion of Bosco's book, which treats of the familiar topic of Roman history, and omits Bosco's chapters that defend the Papal temporal power, and prophesy all sorts of calamities should this not be restored. As also Bosco's pages terminate with the peace that Louis Napoleon hastily concluded with Austria at Villafranca, to the disgust and disappointment of Victor Emmanuel and the people of Italy, Dr. Morell supplements Bosco's narrative by his own, to complete the history of Italy down to the present date. In these supplementary chapters Dr. Morell has successfully imitated the style—suited to young readers—of the Italian priest Bosco, and altogether given us a trustworthy and lucid digest of Italian history. This is, however, hardly attainable by the mass of young students in the extensive and well got up volume before us, which is handsomely printed in imperial octavo, and illustrated with a few—we wish there were more—beautifully executed wood-engravings. A cheap edition of this book would be welcomed by many young students, who may read in the leading features connected with Italy of the great influences that have swayed modern Europe. The bewildering struggles between the Emperors of the East and the tribes of invaders from the North; the formation of a great empire by Charlemagne; the rise of the free towns and small Italian republics; the absorption of European commerce; the struggles for the possession of Italian territory by Spain, France, and Austria; and lastly, the unification of Italy under the house of Savoy, whose founders were Counts of a small territory—about the size of Kent or Sussex—on the western slopes of the Alps, all form threads that are intimately interwoven with the general history of Europe. Dr. Morell is a perfectly safe guide, and we wish he had given us a fuller description of modern Italian progress in education, and other matters developed by the consolidation of the power of Sardinia. The sketch of Italian art is remarkably good, though too brief, and the rise of modern music fairly traced to its Italian sources. One important fact, however, seems to have escaped the notice of most writers on this topic, except Mr. William Chappell, to whose popular music of the olden time we owe the knowledge that rhythmical music was mainly owing to the popular ballad sung to metrical lines, in contradistinction to the *ad libitum* style of recitative that marked other kinds of music.

Longmans' Modern Copy Books. Nos. 7, 8, 10. By. J. Tidmarsh. London: Longmans and Co.

We feel bound to award these three books (No. 7 Double Small Hand, No. 8 Double Small and Small Text, and No. 10 Small Hand) our highest praise. The letters are remarkably well formed, free from needless flourishes, and legible.

The clear, round writing in book 7 is sure to become a favourite with teachers.

Leedam's Exercises in Elementary Arithmetic. London: Philip and Son.

This systematic course of exercises in the first rules of arithmetic is adapted for use in preparatory schools and in private families, and as such has our hearty commendation. Not the least merit of the book is that it is printed in refreshingly large type.

The exercises, which are graduated, provide ample practice in the various rules. We commend the book to the notice of all engaged in private teaching.

Elementary Class-Book of Modern Geography. By William Hughes. Revised by J. Francon Williams. London: Philip and Son.

We have given unqualified praise to the 'Class Book of Modern Geography,' of which the book before us is an abridgment,* and have no hesitation in applying our remarks on the larger to this smaller book. The condensation has been skilfully and carefully done. The information is remarkably full, and, as far as we can see, unfailingly exact. We should have liked to have seen Greenwich included in the towns of Kent, Horsham in Sussex, Dorking and Reigate in Surrey, Bishopstoke in Hampshire, and the towns of Wimborne and Blandford, together with the now important watering-place Bournemouth, in Dorsetshire. But in this professedly condensed book we have little omitted that is important. The information is brought down to the present date, and includes the cession of the Transvaal to the Boers, and the present tentative condition in regard to the government of Zululand. It would be doing also injustice to this book to regard it as a mere compilation. There are judicious explanations given where most required. The preliminary definitions are also very good. The idea going before the word will please all practical teachers, as in the term '*Peninsula.*—A portion of land nearly surrounded by water is called a *Peninsula.*' Again: 'ISTHMUS.—A narrow neck of land which unites any two larger portions is called an *Isthmus.*' This is as it should be, and we may mention also that there are several explanatory definitions not usually met with in introductory class-books; as, for instance, 'COAST.—The line where the land and water meet is called the *Coast,*' and this is supplemented by further useful explanations of the terms *Shore*, *Beach*, etc. The book is altogether one of the best to be met with.

The Second Epistle to the Corinthians. With Explanatory Notes. By the Rev. Henry Linton, M.A. London: Philip and Son.

Mr. Linton is a painstaking and earnest writer. The authorities he adduces are of recognised eminence, and continually and specially referred to on points that occur. This is very different from the too-common practice of merely inserting the titles of books for reference, with the names of authors. After a general analysis a more detailed one is given for the benefit of younger students, and then follow notes to each chapter in succession. The notes, of course, constitute the substance of Mr. Linton's book, and are most worthy of commendation. Reference is made, when needful, to the original Greek for the literal rendering of some passages, and fuller understanding of the text. We could not wish to have a more earnest guide, or one with whom devout reverence and scholarly faithfulness are combined. We ought to add that this forms one of the series of Philips' Scripture Manuals.

Victor Emmanuel. By Edward Dicey, M.A. London: Marcus Ward and Co.

This volume forms one of the series entitled *The New Plutarch*, a title with which we do not complain on the ground of pretentiousness, but hope to see justified by the care exercised by the authors entrusted with its biographies. Some of the volumes published have already obtained a name, and we notice the names of writers of repute engaged in forthcoming works. The life of Victor Emmanuel is, as the author observes, 'the history of Italy from the period of her deepest decline to that of her resurrection as a living nation.' How that history is told in the book before us it behoves us to examine. With these thoughts we began Mr. Dicey's pages, and soon found ourselves in company with an author who was no

* PRACTICAL TEACHER, vol. i., p. 352.

blind enthusiast of remarkable success; in fact, the failings of Victor Emmanuel contributed in no small degree to the regeneration of Italy. The summary of the condition of Italy prior to its unification is able, spirited, and just. The contented submission of the Italians to the French sway and their hatred to that of Austria is well pointed out. After a biographical sketch of the House of Savoy, the primary cause of Italian hatred to the arrangements made at the suppression of the Neapolitan Constitution is tersely described. There was the latent force ever ready for development in the intense and enduring hate of the Italian for the accursed Tedeschi—or Teutonic ruler. It only needed the man to render this latent power active, and though Charles Albert failed, and in failing rendered the Italian cause apparently more hopeless, yet to all thoughtful men the overthrow of the Austrian rule was only a question of time, and as certain to come as rain from a heavily-charged cloud. The victory of Rudetzky at Custozza, after his masterly retreat behind the Quadrilateral, failed to show the Italians that Sardinia must be supported by something more than grandiloquent proclamations, mass demonstrations, cosmopolitan sympathies, and democratic decrees. Charles Albert, worthy of better days, was yet ready to 'try the last,' and did try the last at Novara, where, after a day's long battle, the hopes of Sardinia were crushed, and her king abdicated in favour of his son Victor Emmanuel, and the yearnings of Italy delayed—but only delayed. These introductory sketches occupy one-third of Mr. Dicey's pages. His description of Victor Emmanuel's difficulties and appreciation of his straightforward integrity is singularly clear and able. As the cause of Sardinia was lost by Charles Albert at Novara so it may be said to have been reconstituted by Victor Emmanuel's Moncalièri manifesto, which kept the Austrian bayonets aloof and paved the way for the future brilliant course of Cavour. Indeed, Victor Emmanuel united in himself bravery and prudence as perfectly as he did impetuosity and patience. 'Wait,' he said to the enthusiastic writer, Mapari, 'the day will come, but wait, and for the present I must work here.' Another strange compound in the king's character was his half-superstitious devotion to the church while forced to oppose papal measures. When giving his consent to Siccardi's bill for placing the clergy under the civil power, 'Remember,' said he to Siccardi, 'that you are responsible for this; and if this law send its authors to the devil you will have to go, not I.' On the question of civil marriages the king was even more unwilling to yield, till assured by his old tutor, Charvaz, Archbishop of Genoa, that he might fulfil his duty as a constitutional king without incurring the wrath of Heaven. With all this almost childlike simplicity of belief the king had a keen insight, not only into circumstances, but into character. When the name of Cavour was submitted to him for a subordinate official position, he smiled, and said to the other ministers, 'Your new colleague will soon be your master.' Not less skilful was his checkmating any repressive move of Austria by securing the support of Louis Napoleon. When Cavour came into the field of Sardinian politics the Austrians soon saw the hopelessness of intimidating or crushing Sardinia. The judicious move of joining in the Crimean war restored the reputation of the Sardinian army, and established a claim upon France and England for future assistance. Henceforth the masterly genius of Cavour guided not only both king and people to the goal of Italian unity, but with a force like that of gravitation, and as unseen, drew power after power to aid in the same grand object. The naïveté of the king's character was shown by his reply to the priests who were harassing him with fears for his condition after death while he was bowed down with grief for the loss of his mother, his wife, and his only brother. 'Well,' said the king, 'you see I have others to think about besides myself, and whatever may happen to me in another world I am bound as a sovereign first to secure the happiness of my people in this.' This was really the key-stone to his character. He was devoted to his people and to the unification of Italy. For this latter he worked patiently and unceasingly with perfect readiness to sacrifice himself if needful to attain the object. His sense of personal honour in regard to constitutionalism was unconquerable. When the relations between France and Sardinia became strained by the Orsini attempt, Louis Napoleon urged Victor Emmanuel to take prompt and effective measures to curtail the liberty of the press without the danger of failure and delay in appealing to Parliament. 'I cannot do this,' was the reply, 'as a constitutional king, and have pledged my word always to rule in this manner. Let what will happen, the House of Savoy have preferred the road of exile to the path of dishonour.' The French Emperor saw that it was wiser to let the matter drop with the semblance of a mild alteration in the laws of the press. The irritation of the French was equally directed against England. We replied to the threats of the French colonels by dismissing the popular Lord Palmerston for his supposed sympathy with Louis Napoleon, also by the acquittal of Dr. Bernard, which would probably not have happened but for the threatening attitude of France, and further by starting the volunteer movement.

Our limits will not allow us further to accompany Mr. Dicey through his well-written volume, which has much of the attractiveness of a romance by the dramatic character of the incidents, which led in ten or a dozen short years to the withdrawal of the strongest military power in Europe from the strongest positions of the fairest region of the earth; the willing adhesion of every state and province in the great peninsula to Sardinia; the departure of the French troops from Rome; the romantic career of Garibaldi; the danger of the unyielding Papal opposition; the difficulty of warding off the impossible yet persistent schemes of the republican party, guided by the great intellect of Mazzini; and the other marvellous moves of this the greatest game of political chess ever played by the great powers of Europe.

Science in a Nutshell. By Alexander Watt. W. and A. K. Johnston, Edinburgh and London.

Of Mr. Watt's pleasant writing on Scientific Industries,* we have had before occasion to speak commendingly, and this chatty little book will prove quite as acceptable to young readers, if not to grown-up ones, who desire a simple yet correct introduction to the elements of general science. By a series of experiments, mostly of a simple character and all practicable with ordinary care by amateurs, a considerable knowledge is gained of the leading features of Chemistry, Electricity, Optics, and Pneumatics. The process of Photography is clearly described, and its practice—of course on a simple scale—shown. The same may be said of Electrotyping, and the production on a small scale of the electric light. That the mathematical and demonstrative portions should follow these elementary steps no one will dispute, but we regard this kind of introduction by pleasing and lively experiments the best way to render science attractive, and induce young people to study it. We have been too apt to despise the old popular lectures which largely comprised such experiments as this little book clearly describes. We venture to say in opposition to Pope's maxim that a little science is better than none at all, and that the little, when so pleasingly brought before us by Mr. Watt, is the best prospect of the subject being followed up. Every experiment has its appropriate illustrative diagram. Young readers will, we believe, be charmed with the book.

The Scale of Nations. London: W. H. Guest.

This sheet presents at a glance a comprehensive view of the comparative sizes, areas, population, exports, etc., of the chief countries of the world. It is well arranged and clearly printed.

* PRACTICAL TEACHER, vol. i., p. 516.

Chambers' Graduated Readers. Books I. and II. London and Edinburgh: W. and R. Chambers.

A teacher must be hard to please who does not like this book, and as it is for little boys and girls they must be of the 'very naughty' kind who fail to learn from it. The lessons are well adapted to little beginners in regard to style, and are free from the drawback of affected simplicity. Short script sentences are appended to every lesson, together with words for the scholar to 'pronounce and write.' Further, little exercises are to be written that call up the thought of the little scholar, and the copying of sentences from the printed lesson. At the end are a few pages of cognate words arranged for spelling, together with the addition, subtraction, and multiplication tables. When we add that the book has on nearly every page an appropriate and well-engraved woodcut, its attractiveness to young readers will be admitted. Many of these engravings are really gems in their way. Of these we may mention 'The Bird in the Snow' (p. 66) and 'The Boat on the Lake' (p. 77). The semi-outline pictures are also not unfit for little drawing copies. We should prefer a better capital T to the script exercise on page 29; the one before us may be mistaken for an I or a J. One plain form for script characters is to be preferred.

Book II. does not appear to be so carefully edited in regard to uniformity of style. The well-known verses of the 'Spider and the Fly' are considerably in advance of such little lines as 'O tell me, gentle river,' and Mr. Howitt's ever-popular 'Voice of Spring.' In other respects this is as attractive as the First Book. In addition to the multiplication and pence tables, some capital explanatory little tables are given of the component parts of shillings, florins, etc.

Simple Interest, with Models, Hints for Working, Cautions and Numerous Examples. By Rev. H. F. W. Cowley, B A. London: Lewis, Gower Street.

Students cannot do better than follow the guidance of Mr. Cowley in this branch of Arithmetic. The *Rules*, as we are in the habit of calling them, are properly introduced by explanatory working of examples which will serve as models for examination papers, while the formula is then given and clearly understood. The examples are numerous, varied, and of practical utility for all descriptions of business. The book is supplemented by 100 examples taken from various examination papers. We should like to see Compound Interest, Annuities, etc., treated in the same lucid and useful manner.

Ellery's English Arithmetical Test Cards in Six Packets for Standards II. to VII. London: W. and R. Chambers.

In every respect this set of cards merits our approval. The whole plan is excellent. Complaints have reached us by the score that but few of the numerous test cards in the market contain examples of sufficient difficulty. To meet this want, Mr. Ellery has, wisely, we think, reserved the last ten cards in each packet for advanced work. Special praise should also be given to the cards for Standard VII., which 'form a thorough course in advanced arithmetic, and may well be used by young pupil teachers and by students for the Excise and other public examinations, as well as by the pupils for whom they are more especially designed.' We must not forget to mention that the questions are based on those set by Inspectors, and fully meet the latest requirements of the Code.

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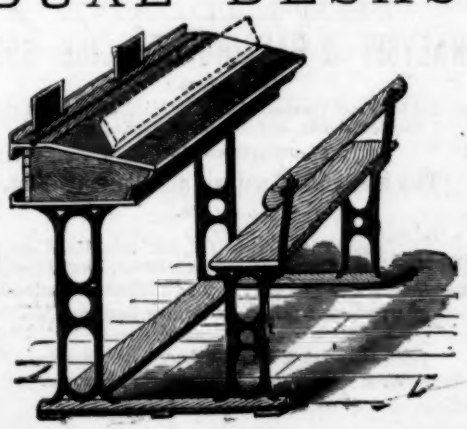

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